United States Department of Agriculture
Forest Service

Cumbres Vegetation Management Project
Draft Environmental Impact Statement

Conejos Peak Ranger District, Rio Grande National Forest, Conejos County, Colorado

December 2013

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Cumbres Vegetation Management Project
Draft Environmental Impact Statement
Conejos County, Colorado

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This document is available on the internet at:
http://www.fs.usda.gov/projects/riogrande/landmanagement/projects

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ABSTRACT: This Draft Environmental Impact Statement (DEIS) evaluates the potential effects of the short-term benefits of salvaging timber stands being killed by spruce beetle and the need for long-term regeneration of the future forest, implementing fuel reduction treatments adjacent to private land, and managing hazard trees that may impact infrastructure in the Cumbres project area. It discloses the direct, indirect, and cumulative effects of a proposed action and alternative actions for vegetation management in this analysis area. This document follows the format established in the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations {CFR} Parts 1500-1508). It includes a discussion of the need for the proposal, alternatives to the proposal, the impacts of the proposed action and alternatives, and a listing of agencies consulted. It is tiered to the 1996 Revised Land and Resource Management Plan, as amended (Forest Plan), for the Rio Grande National Forest and the Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) issued for the Forest Plan.

Summary

Currently much of the high elevation portions of the Rio Grande National Forest are experiencing extensive mortality of Engelmann spruce (*Picea engelmannii*) trees resulting from epidemic spruce beetle (*Dendroctonus rufipennis)* populations. Aerial surveys completed by the Forest Service's Forest Health Protection Service Center out of Gunnison, CO have shown spruce beetles have infested and killed over 32,500 "footprint" acres of Engelmann spruce in Conejos County since 2001.

Spruce beetle activity has steadily increased across the Forest. Heavy spruce beetle infestations were first noted in the winter of 2003 in the southern portions of the nearby County Line Analysis Area. Since that time, spruce beetles have progressed northward into the Rio de Los Pinos Analysis Area (2010) and most recently moved eastward towards into the Cumbres analysis area.

The Rio Grande National Forest proposes to salvage dead and dying spruce to capture economic value in the short-term, but also to reduce the number of potential hazard trees in key areas to protect infrastructure, evaluate regeneration needs to meet long term desired conditions considering stocking requirements, wildlife habitat, and the desired rate of ecological recovery.

The area affected by the proposal includes Engelmann spruce dominated stands located on National Forest System lands approximately 23 miles west of Antonito, Colorado in Conejos County. The project analysis area includes approximately 3,541 acres. Private land is located on the northeast and southwest edges. This action is needed to move toward desired conditions as described in the Forest Plan for this Management Area Prescription(s).

Areas of Controversy

No major areas of controversy were identified during scoping.

Issues raised by Agencies and Public

Concerns identified during scoping included the potential effects of proposed activities on wildlife habitat, watershed health, soils, scenery, recreation, and local communities. These preliminary issues were evaluated to determine whether they were already resolved through land use designations, implementation of Forest Plan standards and guidelines and Best Management Practices (BMP's), project-specific design criteria, through processes or analyses routinely conducted by the Interdisciplinary Team (IDT or ID Team), or were beyond the scope of the project. All concerns that fell within these categories were considered resolved. Concerns that would have to be addressed through spatial location of activities or that would drive (or partially drive) an alternative were considered unresolved. These unresolved concerns were developed into issues.

Issues to be Resolved

Concerns that would need to be addressed through the spatial location of activities or that would drive or partially drive an alternative were considered unresolved. These unresolved concerns were developed into issues. Three issues were identified for this analysis. These issues led the agency to develop alternatives to the proposed action including: Alternative 1 – No Action and Alternative 3 – Limited Action. Each action alternative was designed to be viable and consistent with Forest Plan direction. The action alternatives propose varying degrees of treatments which include salvage harvesting, forest stand regeneration activities, fuels reduction adjacent to private land, and hazard tree removal to protect infrastructure. Project Design Criteria are incorporated in each action alternative to protect other resources. Alternative 2 is the proposed action and is considered the preferred alternative.

Major conclusions include:

When evaluating effects between the alternatives, it was found that the No Action alternative would likely have the fewest short-term effects for most resources, though there could be long-term effects as dead trees fall and impede movement or damage infrastructure. The relatively slow rate of forest stand recovery could be detrimental to some resources. Fuel loadings would continue to increase as snags fall, adding to high severity fire potential. No Action would not benefit the local forest products industry.

The Action alternatives would have some short-term disturbance effects during harvest activities to wildlife and some Forest users. There could be some positive benefit to local industry. Mid to long-term, there is low risk for any adverse effects to resources. Accelerated stand regeneration would be positive in the long-term for all resources. Reducing potential long-term fuel loadings would reduce the risk for widespread high severity fires in the analysis area and reduce firefighter safety concerns. The action alternatives would also do more to protect existing infrastructure.

The Forest Service has prepared this EIS in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. Based upon the effects of the alternatives, the Responsible Official will decide whether or not to authorize some level of action on all, part, or none of the analysis area. The decision will be documented in a Record of Decision (ROD) accompanying the Final EIS after receiving and considering public comment.

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CHAPTER 1. Purpose and Need for Action

1.1 Introduction

The Forest Service has prepared this environmental impact statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This environmental impact statement (EIS) discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives.

Additional documentation, including more detailed analyses of project area resources, may be found in the project planning record located at the Conejos Peak Ranger District, Rio Grande National Forest.

1.2 Background

Currently much of the high elevation portions of the Rio Grande National Forest are experiencing extensive mortality of Engelmann spruce (*Picea engelmannii*) trees resulting from epidemic spruce beetle (*Dendroctonus rufipennis)* populations. The latest aerial surveys completed by the Forest Service's Forest Health Protection Service Center out of Gunnison, CO have shown spruce beetles have infested over 32,800 "footprint" acres of spruce in Conejos County since 2001[1]. This is an increase of over 12,000 acres from 2011 to 2012. Figure 1-3 shows the aerial extent of cumulative spruce beetle mortality in the Cumbres project area and vicinity as of the summer of 2012.

Spruce beetle activity has steadily increased across the Forest. Heavy spruce beetle infestations were first noted in the winter of 2003 in the southern portions of the nearby County Line Analysis Area. Since that time, spruce beetles have progressed northward into the Rio de Los Pinos Analysis Area (2010) and most recently moved towards the east into the Cumbres Analysis Area.

As shown in figure 1-1, the proposed Cumbres Vegetation Management Project (Cumbres Project) area is located on National Forest System lands about 23 miles west of Antonito, Colorado and south of the Trujillo Meadows Reservoir in Conejos County. The project analysis area includes approximately 3,541 total acres. Legal description for the analysis area is: T 32 N, R 5 E, Sections 4 through 9, 17; T 33 N, R 5 E, Section 31; T 32 N, R 4 E, Section 1, 12; T 33 N, R 4 E, Sections 25, 36, New Mexico P.M.

1.3 Purpose and Need for Action

The purpose of this project is to:

- Salvage dead or dying trees while the value remains high in stands designated for multiple use management and are part of the suitable timber base.
- Regenerate treated portions of the forested acres killed by bark beetles in order to accelerate the rate of forest and ecological recovery over the long term.
- Treat potential hazard trees in areas of concentrated public use, along private property, roads, and other infrastructure.
- Reduce the accumulation of large diameter fuels in areas severely impacted by the spruce beetle, especially those adjacent to private land.

1 Spruce beetle detection by aerial surveys underestimates actual acres infested, since spruce fade over 2 to 3 years compared to distinctly changing colors like pines. Ground surveys have found many more acres infested across the District

- Utilize the existing transportation network as much as possible to minimize both resource impacts and road construction costs.
- Provide forest and wood products, such as fuelwood, sawtimber or house logs, to the people of the San Luis Valley and/or other areas.

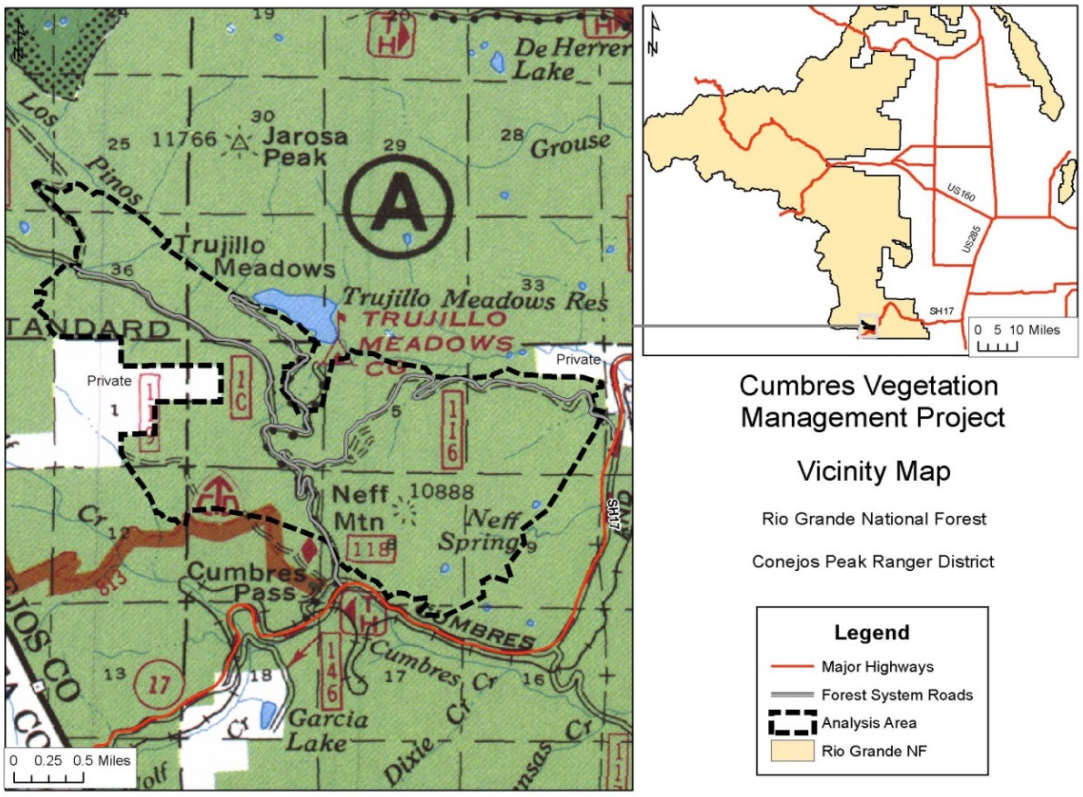

Figure 1-1. Vicinity map, Cumbres Vegetation Management Project.

1.4 Forest Plan and Related Direction

All land management decisions are governed by an array of laws and policy which direct or provide bounds for decisions. While some laws and policy provide constraints, others provide intent and direction for certain actions to occur.

This action is needed to respond to the widespread tree mortality caused by the ongoing spruce beetle epidemic. This proposal responds to the desired conditions and objectives as described in the Forest Plan, Rio Grande National Forest Land and Resource Management Plan (USDA Forest Service 1996, as amended) and moves the project area toward desired conditions described in that plan. This DEIS is tiered to the Forest Plan Final EIS. Forest Plan desired conditions and objectives for this analysis are listed in table 1-1 below. Objectives are "concise projections of measurable, time-specific intended outcomes. The objectives for a plan are the means of measuring progress toward achieving or maintaining desired conditions (36 CFR 219.7(a)(2)(ii))."

The Forest Plan FEIS addresses concerns about forest health and the potential for spruce beetle epidemics (FEIS pp. 3-219 to 3-221). Forest-wide objectives include reducing insect and disease infestations and using a range of silvicultural prescriptions to achieve ecosystem management objectives (Forest Plan p. II-3). The Forest Plan FEIS also addresses the demonstrated and ongoing

demand for wood and miscellaneous forest products such as firewood and poles (FEIS p. 3-159). Any regulated timber harvest activities would occur on lands classified as suitable for timber production, as per the Timber Suitability amendment to the Forest Plan (3/2/2000).

Table 1-1. Forest Plan Desired Conditions (goals) and objectives for this project

Forest-wide Desired Conditions	Forest-wide Objectives
Vegetative structure on the Forest is capable of sustaining timber harvesting that supplies wood products for humankind while providing for biological diversity of those forested areas. **Harvest operations are designed to emulate smaller-scale disturbance events or processes.** **The amount, arrangement, and continuity of live and/or dead material, which would contribute to fire spread (fuel profiles), are consistent with land uses and estimates of historic fire regimes.**	**2.2**. Manage the Forest to maintain or improve the health and vigor of all native plant associations. **2.8.** Treat aspen stands to maintain or improve wildlife and scenic values **2.10** Use appropriate vegetative-management methods to modify unacceptable fuel profiles and reduce potentially unacceptable future high-intensity wildfires.
Special forest products, such as firewood…continue to be available from the Forest… **The Forest recognizes the needs of people from the San Luis Valley and surrounding areas, and strives to meet their needs for forest and wood products, while protecting those resources for future generations.**	**3.2.** Emphasize long-term sustainable production of resources for economies, communities, and people. **3.3.** Use a range of silvicultural prescriptions to achieve ecosystem management objectives. These objectives may include supplying forage for wildlife, reducing insect and disease infestations, maintaining or improving aspen stands, or enhancing scenery. **3.4.** Use existing roads, instead of constructing new ones.
Provide for scenic quality and a range of recreational opportunities that respond to the needs of Forest customers and local communities.	**4.1** Provide natural appearing landscapes with diverse scenery, and increase access to recreation opportunities in attractive settings. Meet scenic integrity objectives as described in the Forest Plan.
Improve the financial efficiency of all programs and projects.	**6.2.** Manage, as much as practicable, the Forest's market oriented programs (timber, range, minerals, and special uses), so that they are financially profitable.
Emphasize cooperation with individuals, organizations, and other agencies while coordinating planning and project implementation.	**7.1.** Cooperate with all people, including those whose livelihood is dependent on National Forest resources, in the development of plans and projects. **7.2.** Cooperate with federal, state, local, and tribal governments, as well as private organizations and individuals, to: promote rural-development efforts…reduce loss of wildlands and structures to wildfires.
Promote rural development.	**8.1** Be a leader in working with rural people and communities including American Indian tribes, to develop opportunities and enterprise that contribute to their economic and social vitality. **8.2** Recognize the nature and extent of local economic dependencies on National Forest activities. Give special attention to resources that help diversify rural economies.
General Infrastructure.	-Facilities are safe, accessible …. as needed to achieve resource management objectives. -Forest work programs are conducted within the guidelines of the National Health and Safety Codes and the Occupational Safety and Health Administration.
Conserve and promote Canada lynx recovery (SRLA 2008)	- Manage vegetation to mimic or approximate natural succession and disturbance processes while maintain habitat components for lynx conservation (VEG O1). -Provide a mosaic of habitat conditions through time that support dense horizontal cover and high densities of

Forest-wide Desired Conditions	Forest-wide Objectives
	snowshoe hare. Provide snowshoe hare habitat in both the stand initiation structural stage (SISS) and mature, multi-story conifer vegetation (VEG O2). -Focus vegetation management in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover (VEG O4).

The Forest Plan assigned land areas designated to be managed for a particular emphasis or theme known as Management Area Prescriptions (MAPs). Each MAP in the Forest Plan includes a description of the theme and physical setting, along with a description of the desired future conditions for that area. Each MAP also has and a list of Standards and Guidelines that apply and that are used during project implementation to help achieve Forest Plan desired conditions and objectives. Table 1-2 describes the Forest Plan MAP theme and acres are within the project area and figure 1-2 shows their spatial distribution.

Table 1-2. Forest Plan Management Area Prescriptions, Cumbres Project Area

Forest Plan MAP	MAP Theme description	Acres
5.11 – General Forest and Intermingled Rangelands[1]	Allow a variety of management options, such as livestock grazing, wildlife habitat, dispersed recreation, mineral development, and timber harvest. Management emphasis is on a balance of resources uses.	3,209
5.13 – Forest Products[1]	Allow a full range of activities, with emphasis on the production of commercial wood products. Numerous open roads offer commercial access and roaded recreation opportunities, while restricted roads offer non-motorized recreation opportunities.	337
Total Acres		***3,541***
[1]MAP included in the suitable timber base.		

The Forest Plan goals can be reviewed online at:
http://www.fs.usda.gov/main/riogrande/landmanagement/planning

Where consistent with other Forest Plan goals and objectives, there is Congressional intent to allow timber harvesting on suitable lands (*Organic Administration Act of 1897, Multiple-Use Sustained-Yield Act of 1960; Forest and Rangeland Renewable Resources Planning Act of 1974; Federal Land Policy and Management Act of 1976; National Forest Management Act of 1976).* Intent is also expressed to allow the salvage of dead timber (*Forest and Rangeland Renewable Resources Planning Act of 1974).* Such actions are also directed and authorized by Federal Regulation (*36 CFR 221.3; 36 CFR 223).* In keeping with these intents, it is Forest Service policy to provide timber resources to the local and regional economy (*Forest Service Manual [FSM] 2402; Forest Plan, pp. II-3 through II-4)*, salvage dead trees (*FSM 2435)*, and treat stands experiencing insect or disease infestations or to prevent infestations (*Forest Plan IV-25 through IV-28).*

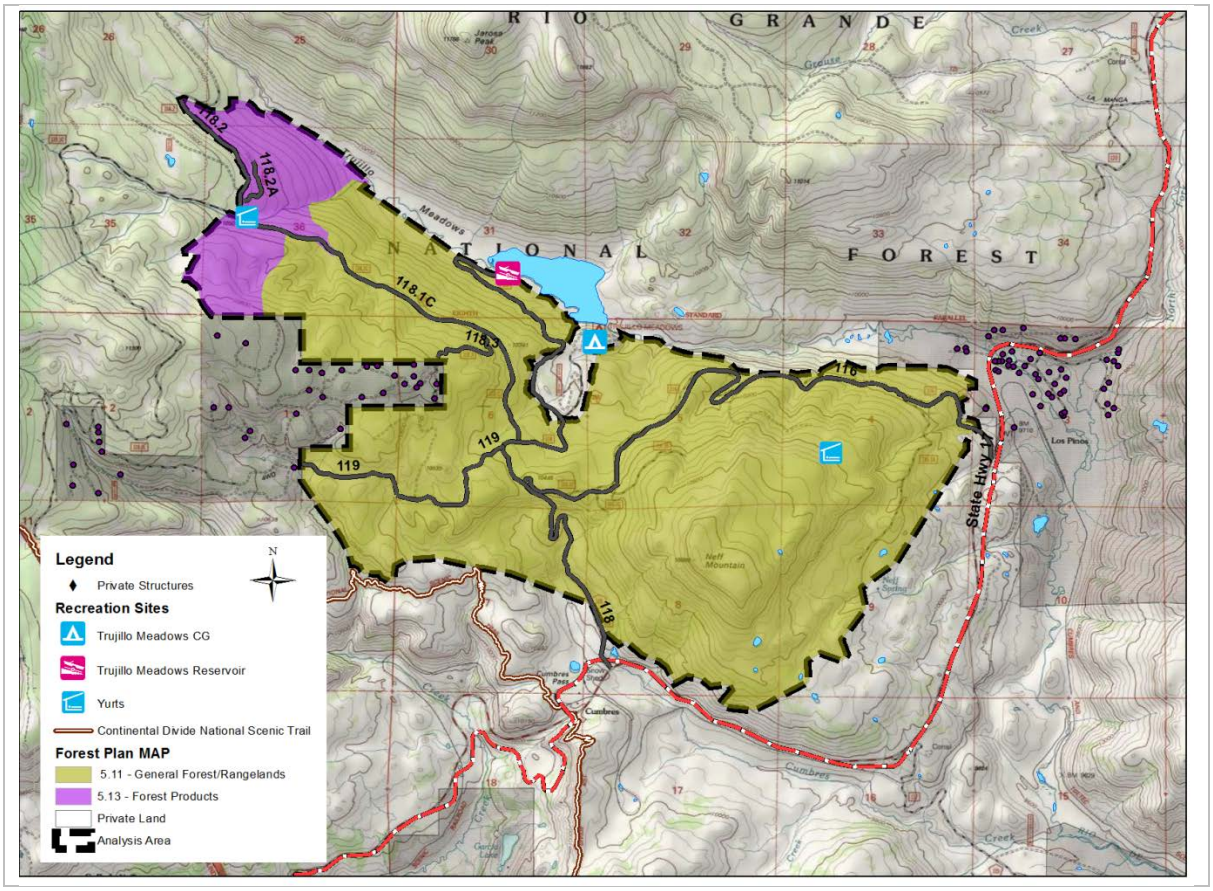

Figure 1-2. Forest Plan MAPs, recreation developments, and private structures in project vicinity.

Silviculturally, salvage harvest is typically considered an Intermediate harvest. However, when tree mortality is so extensive that the stand is being returned to a regenerated stage, the prescribed harvest is then described as a regeneration harvest (FSM 2470 – Silvicultural Practices, Section 2471.3). Since mortality of the mature Engelmann spruce stands in the Cumbres project is generally 90 percent or greater (refer to chapter 3, Timber Management), a salvage harvest would be considered the final removal. Therefore, any salvage harvest would be coded as a type of regeneration harvest based on what best describes the residual stand characteristics.

1.5 Proposed Action

In response to the purpose and need for action, the Forest proposes to use ground-based equipment to salvage and regenerate up to 2,498 acres of beetle infested Engelmann spruce stands. Only dead and dying spruce 8 inches diameter breast height (dbh) and larger would be considered for harvest. Hazard tree removal would be implemented within a distance of up to 2.0 tree heights from open roads, fences, private land, or recreation facilities. Hazard distance would depend on localized factors such as slope, topography, and/or the number and arrangement of potentially hazardous trees. To improve defensible space, fuel reduction treatments would be implemented in Wildland-Urban Interface (WUI) areas up to 400 feet from adjacent private land on approximately 171 acres.

The proposed action is expected to begin in 2014 and be implemented over the next 10 years. Tree planting would not occur until other operations have been substantially completed in an area.

1.6 Decision Framework

Given the purpose and need, the deciding official will review the proposed action, the other alternatives, and the environmental consequences disclosed in this document in order to make the following decisions:

- Will project activities be implemented as proposed, as modified, or not at all?
- If project activities proceed, which project design features or monitoring items will be incorporated?

A Final Environmental Impact Statement and Record of Decision (ROD) will be prepared after receiving comments on this document. The ROD will explain the rationale for the decision and disclose how the decision responds to the issues and moves toward desired conditions.

1.7 Public Involvement

The Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on July 29, 2013. The NOI asked for public comment on the proposal prior to August 28 2013. In addition, as part of the public involvement process, a scoping notice was published in the Valley Courier, the newspaper of record, on July 25, 2013. Two comment letters were received.

The proposed project was originally scoped in March of 2011 in preparation for completing an Environmental Assessment. That scoping letter was mailed to 136 individuals, organizations, government agencies, and Tribal contacts. Eleven letters were received in response to scoping in 2011. Of those, three were supportive or had no concerns, unless cultural resources were identified, and eight had issue(s) or concerns that needed to be addressed. Comments from this process were used to identify issues and develop alternatives to the Proposed Action and an *EA for Comment (draft)* was released in June 2012. The project has also been listed on the Schedule of Proposed Actions (SOPA) since 2011.

When the Responsible Official decided that an Environmental Impact Statement should be prepared, all those that commented in 2011 and 2012 were notified of the change and assured that the comments provided previously would be used as the analysis process continued.

1.8 Issues

As described in Forest Service Handbook (FSH) 1909.10, issues are: a) cause and effect statements that serve to highlight effects or unintended consequences that may occur from the proposed action and alternatives; b) used to identify opportunities during the analysis to reduce adverse effects; and c) used to compare trade-offs in an understandable and, if possible, quantitative manner. The process is intended to ensure that all key issues are identified and that all relevant issues are appropriately addressed in the analysis.

The Forest Service separated the issues into two groups: key and non-key issues. Key issues were defined as those directly or indirectly caused by implementing the proposed action. Non- key issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; 4) conjectural and not supported by scientific or factual evidence; or 5) concerns that the IDT felt would be addressed as part of the analysis, by Forest Plan Standards and Guidelines (S&G), Best Management Practices (BMPs), Project Design Criteria (PDC), mitigation measures, and/or monitoring. The issue analysis process is documented and is part of the project record.

The Forest Service identified three key issues (hereafter referred to as Issues) for the Cumbres Project. The issue statements and selected Measurement Indicators (Indicators) were identified or developed by the IDT in response to scoping comments and used to: develop an additional action alternative, to focus the analysis, use as discussion points, and to compare potential effects of each alternative for this project.

Issue 1 - Spruce beetle populations have exceeded endemic levels and may have moved forest stands away from Forest Plan Desired Conditions of protecting and promoting forest products, while perpetuating landscape diversity.

Indicators:

- Acres, distribution, and species composition of stands regenerated to desired stocking levels;
- Tons per acre of large diameter fuel removed and effect on potential fire severity;
- Acres salvaged;
- Volume of commercial forest products recovered.

Issue 2 – Project activities may impact watershed condition, water quality, and site productivity by increasing soil compaction, erosion, sedimentation, and altering water flows.

Indicators:

- Total acres treated;
- Percent area surface disturbance by watershed;
- Miles of old non-system roads re-opened
- Miles of road maintenance;
- Miles of new temporary road construction;
- Percent increase in connected disturbed area.

Issue 3 – Project activities may impact suitable lynx habitat as defined by the Southern Rockies Lynx Amendment to the Forest Plan.

Indicators:

- Total acres of suitable lynx habitat affected in the Rito Archuleta Lynx Analysis Unit (LAU);
- Acres of incidental impacts to dense horizontal cover (DHC) in the short term;
- Acres of suitable habitat converted to the stand initiation structural stage (SISS).

1.9 Other Related Efforts

There are no other known projects or efforts that would affect the proposed actions or the decision to be made.

CHAPTER 2. Alternatives, Including the Proposed Action

2.1 Introduction

This chapter describes and compares the alternatives developed to meet the purpose and need for the Cumbres Vegetation Management Project (Cumbres Project). It includes a description and map of each alternative considered in detail. This chapter also describes the environmental consequences of the proposed action and alternatives in comparative form, as measured in chapter 3, to define the differences between the alternatives and provide a basis for choice among the options by the responsible official and the public.

2.2 Alternatives Considered in Detail

The Forest Service developed three alternatives, including the No Action and Proposed Action, in response to issues raised by the public during scoping. Alternative(s) considered, but dropped from detailed study are also listed below. Collectively, these alternatives represent a reasonable range of alternatives given the site-specific situation, purpose and need, and issues for this project. Table 2-3 provides a comparison of the alternatives considered and analyzed in detail, organized by resource.

Alternative 1 – No Action

Figure 2-1, shows the cumulative "footprint" acres mapped by aerial detection surveys as being infested by spruce beetle from 2001 through 2012 in the Cumbres analysis vicinity. To date, over 1,987 acres of spruce stands have been affected to various degrees in the project area, which is an increase of over 780 acres since 2011; the Forest FSVeg database has about 2,447 acres mapped as spruce/fir stands. Based on current trends and field surveys, it is expected that dead Engelmann spruce will dominate the landscape on most of these acres within less than 5 years.

Under No Action, natural processes would continue. No salvage of dead or dying trees would occur beyond those areas open to permitted firewood cutting. Seedlings would not be planted to reforest under-stocked stands or to improve species composition. Over time, tons per acre of large diameter down fuel would continue to increase as trees die and fall. Hazard tree removal would be done as part of maintenance activities by road crews, recreation facility managers, homeowners, or livestock permittees on an ongoing basis. Wildland-Urban Interface (WUI) fuels reduction treatments adjacent to private land would not occur. System roads would be maintained as funding permits. Other activities, such as livestock grazing and dispersed recreation would continue.

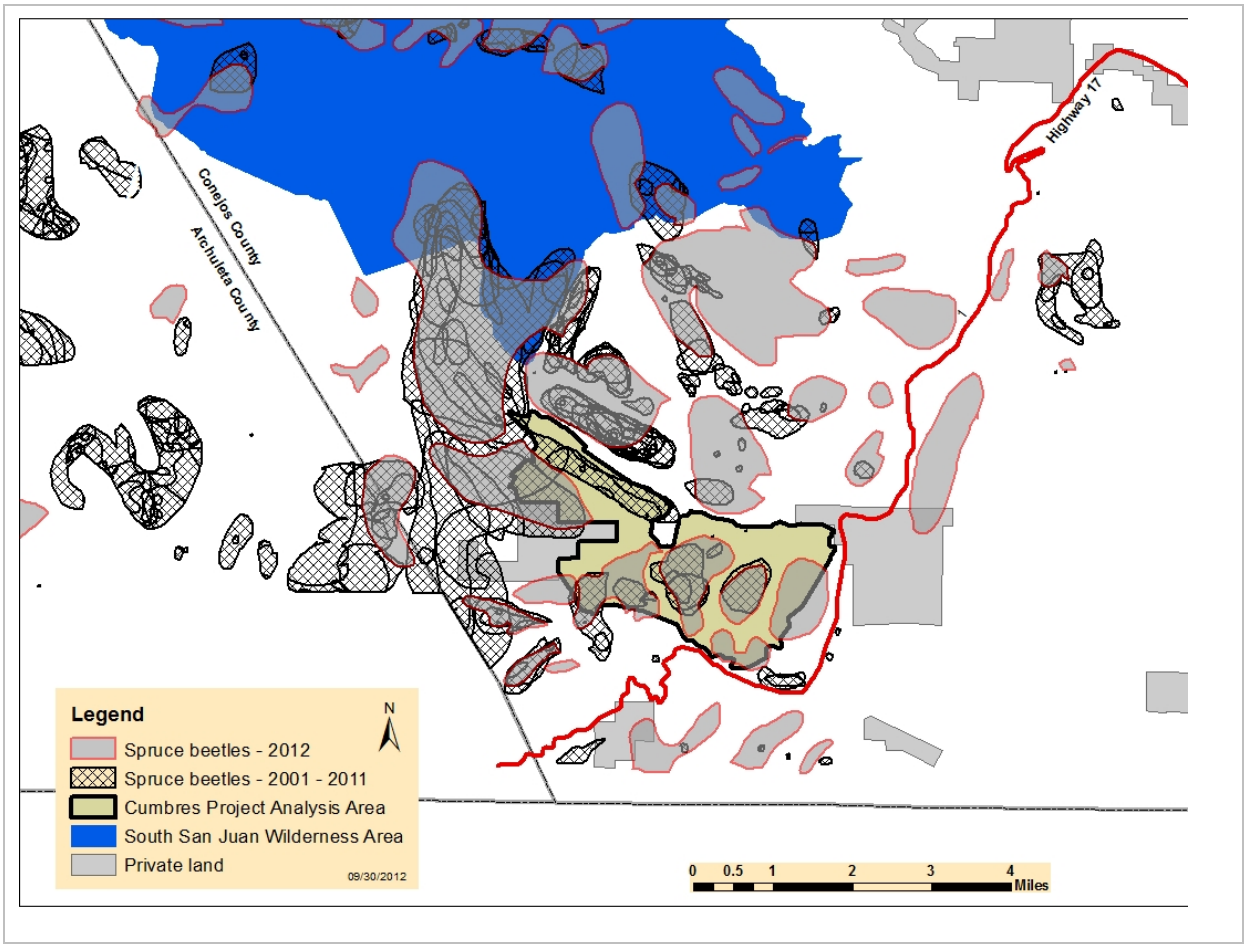

Figure 2-1. Cumulative spruce beetle infested stands, Cumbres project vicinity, 2001 through 2012.

Alternative 2 - Proposed Action (*Preferred Alternative*)

Proposed treatment areas and road system needed under this alternative are shown in figure 2-2. Under this alternative, salvage harvest would be implemented to recover wood product value from dead and dying spruce. Trees would be harvested only on slopes less than 40 percent and suitable for ground-based logging equipment. Merchantable trees, 8 inches diameter breast height (dbh) and larger, would be considered for harvest. All or parts of cut trees would be skid to designated landings. Tons per acre of expected large diameter fuels would be decreased on treated acres. Salvage harvest would occur on up to 2,498 acres. It is estimated that about 22 acres of landings would be needed across the project area. Landings from previous harvests would be re-used as much as possible to minimize additional disturbance.

This alternative would require the following road system:

- Construction of about 0.8 miles of new temporary road segments;
- Maintenance/reconstruction and use of about 7.5 miles of old, non-system roads from previous harvests;[2]
- Maintenance and reconstruction of about 5.8 miles of decommissioned NFS (National Forest System) roads;
- Maintenance and use of 5.0 miles of NFS roads currently closed to public travel;
- Maintenance and use of 12.5 miles of NFS roads currently open to public travel.

Following harvest activities, treated areas would be surveyed to evaluate the health, species composition, and distribution of residual trees. Areas not meeting desired forest stocking, composition, or distribution requirements would be hand planted with Engelmann spruce seedlings within 5 years following harvest. Exact planting acres would be determined by the stocking surveys, but it is estimated that about 650 acres would be planted.

Aspen is a minor component in the project area; existing clones would be protected while promoting their expansion to the extent possible. Aspen clones would be maintained and expanded within the treatment areas by reducing conifer encroachment by hand-felling conifers less than about 8 inches dbh growing under the aspen. Clone expansion would be completed by cutting all conifers within one tree-length of aspen clones on up to 20 acres. Salvage activity adjacent to these clones would be intended to stimulate new sprouting and clone expansion. No harvest of aspen trees would occur.

Hazard tree removal would be implemented within a distance up to 2.0 tree heights from open roads, fences, private land, or other infrastructure. Where feasible, these trees would be cut and removed as part of timber harvest activities; otherwise they would be felled, bucked, and left in place.

To improve defensible space, fuel reduction treatments would be implemented within 400 feet of adjacent private land on approximately 171 acres. These treatments would focus on thinning understory trees and shrubs, as needed, to modify potential fire behavior. Treatments could consist of cutting vegetation with chainsaws and handpiling slash or grinding it with mechanized equipment.

Any slash piles created during project activities would be burned during favorable weather conditions.

Three (3) accessible areas adjacent to open roads would be reserved for personal use firewood gathering. This alternative would designate 97 acres for this purpose.

[2] Old, non-system roads from previous harvests are also temporary roads. However, since the surface area has been previously disturbed their re-use does not add substantial additional disturbance, they are tracked separately from potential new disturbed areas.

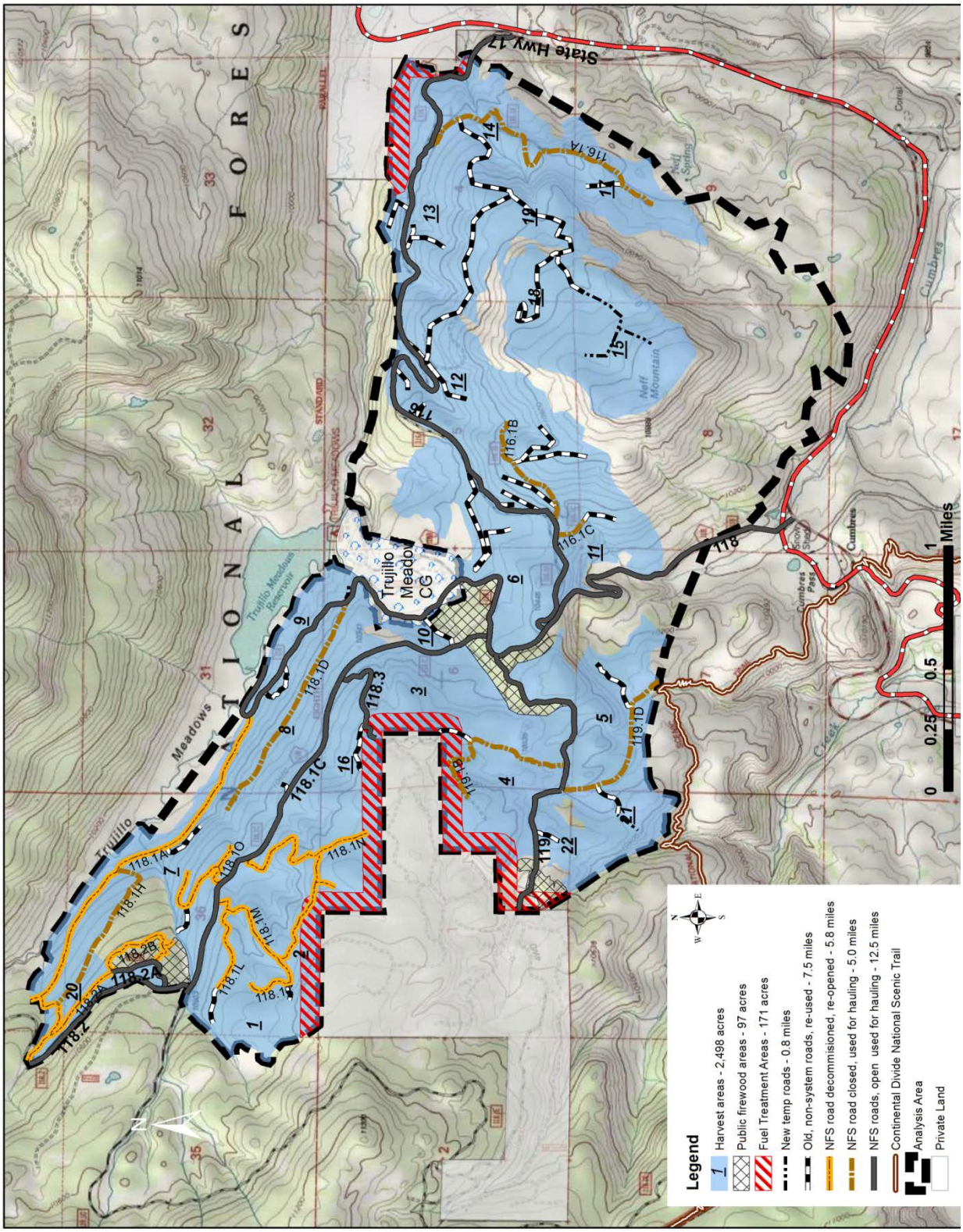

Figure 2-2. Proposed harvest areas and road system, Alternative 2.

Alternative 3 – Limited Action

Proposed treatment areas and road system needed under this alternative are shown in figure 2-3. All activities described under Alternative 2, Proposed Action, would occur under this Alternative, except fewer acres would be harvested and fewer acres would be planted. Tons per acre of expected large diameter fuels would be decreased, but on fewer treated acres. Since fewer acres would be harvested, fewer acres would be needed for landings and fewer miles of system and non-system roads would be required. Salvage harvest would occur on up to 1,549 acres. It is estimated that about 15 acres of landings would be needed across the project area. Landings from previous harvests would be re-used as much as possible to minimize additional disturbance.

As with alternative 2, aspen clones would be maintained and expanded within the treatment areas by reducing conifer encroachment by hand-felling conifers less than about 8 inches dbh growing under the aspen. Clone expansion would be completed by cutting all conifers within one tree-length of aspen clones on up to 20 acres. Salvage activity adjacent to these clones would be intended to stimulate new sprouting and clone expansion. No harvest of aspen trees would occur.

This alternative would require the following road system:

- Construction of about 0.1 miles of new temporary road segments;
- Maintenance/reconstruction and use of about 4.3 miles of old, non-system roads from previous harvests;[3]
- Maintenance and reconstruction of about 0.6 miles of previously decommissioned NFS roads;
- Maintenance and use of 4.9 miles of NFS roads currently closed to public travel;
- Maintenance and use of 10.9 miles of NFS roads currently open to public travel.

Following harvest activities, harvested areas would be surveyed to evaluate the health, species composition, and distribution of residual trees. Exact planting acres would be determined with stocking surveys following harvest, but it is estimated that about 170 acres would be planted.

Any slash piles created during project activities would be burned during favorable weather conditions. Hazard tree removal and fuel reduction treatments would be the same as described under the Proposed Action. Two (2) accessible areas adjacent to open roads would be reserved for personal use firewood gathering. This alternative would designate 73 acres for this purpose.

[3] Old, non-system roads from previous harvests are also temporary roads. However, since the surface area has been previously disturbed their re-use does not add substantial additional disturbance, they are tracked separately from potential new disturbed areas.

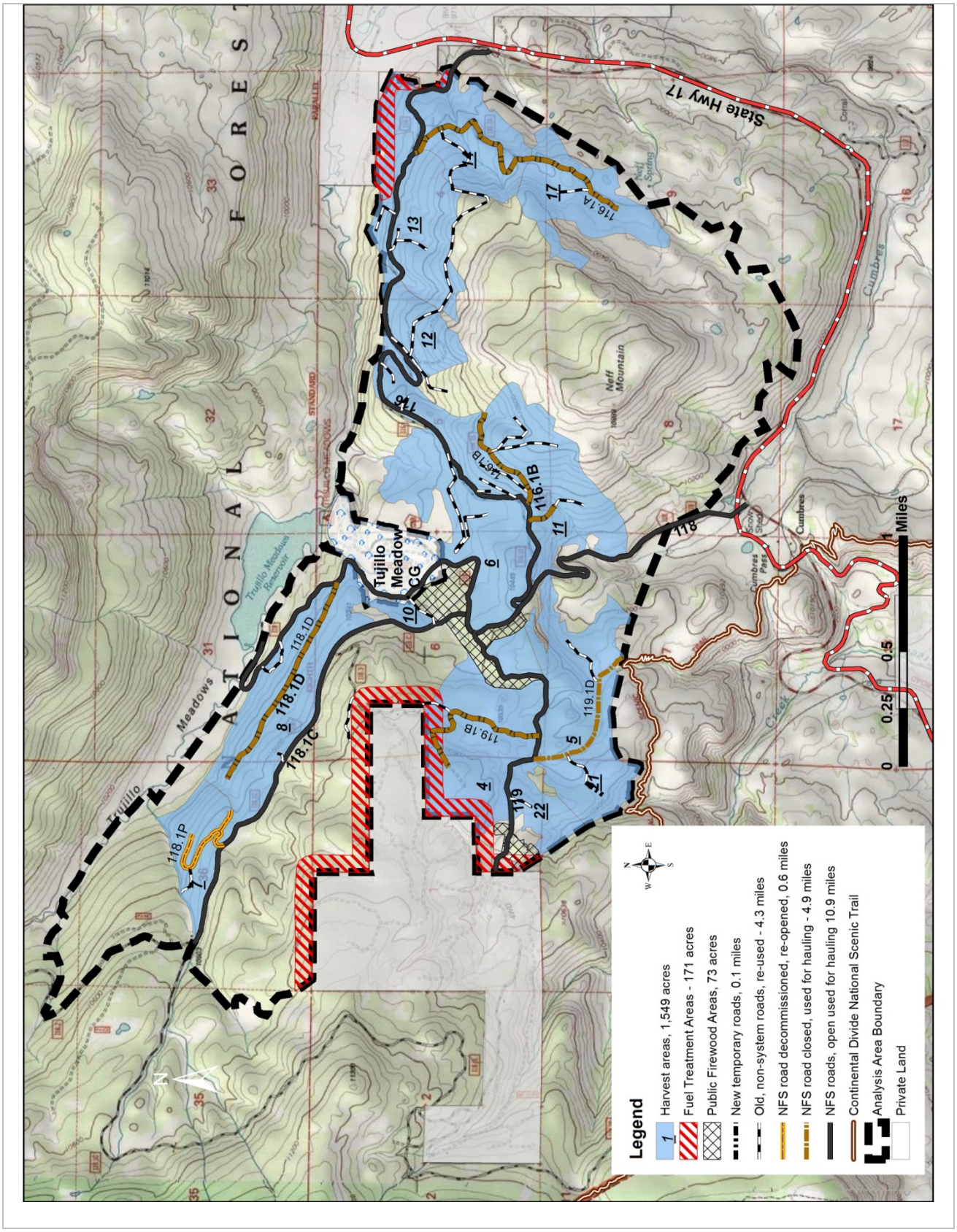

Figure 2-3. Proposed harvest areas and road system, Alternative 3

2.3 Project Design Criteria and Mitigation Common to All Action Alternatives

The Forest Service uses many measures to reduce or prevent negative impacts to the environment in the planning and implementation of management activities. The application of these measures begins at the project planning and design phase. Forest Plan Standards and Guidelines and Best Management Practices (BMPs) as incorporated in the R2 Watershed Conservation Practices Handbook (FSH 2509.25) are the first protection measures to be applied. Both of these sources are incorporated by reference. Other Project Design Criteria (PDC) has been included, as needed. The PDC listed in table 2-1 have been found to be effective in reducing potential impacts. Each PDC statement would apply to both Alternative 2 and 3.

Table 2-1. Project Design Criteria for Alternatives 2 and 3.

Action
Timing of Operations
No hauling during July 3rd through the 5th or weekends from Friday noon to Sunday midnight during big game rifle season.
Under most conditions and unless approved by the District Ranger, logging operations will not be permitted from December 15 to April 1 to reduce potential conflicts with winter recreation activities.
Wildlife/TES/MIS
The project has been surveyed for TES and MIS species. Surveys will continue during project implementation. If a species are discovered, they will be protected as indicated in the Forest Plan with consultation with the U.S. Fish and Wildlife Service, as necessary.
Gated roads or other closed roads utilized during logging activities and following logging will remain closed to the general public to minimize wildlife disturbance (and for public safety). An exception may be temporarily opening roads for public firewood collection following harvest.
Noxious Weed Management
All organic material used for rehabilitation: seed, straw, erosion control material, or other, will be certified weed free.
By use of standard contract provisions, the timber purchaser or other contractors will be required to clean all logging and construction equipment that operates off roads, prior to entry to the project area.
Prior to the start of logging or other new ground disturbance activities, areas will be surveyed and treated for existing populations of weeds.
Haul routes and highly disturbed areas, such as landings, will be treated for noxious weed infestations, as needed, for five years following harvest.
Road fill and road base material brought in off site will come from a borrow source free of State Listed Noxious Weeds. The Forest Service will inspect and approve the borrow source location prior to materials being hauled to the project area; areas where borrow material is applied will be documented and inspected for weeds for three years following application.
Livestock Management
Forest regeneration will be protected from livestock grazing by using adaptive strategies such as reducing cattle concentrations by avoiding salt/supplement placement in regenerating areas, avoid pushing large numbers of cattle into the area, use riders if needed to disperse large numbers, and maintaining pasture rotation to avoid season-long grazing.
If current natural barriers are made ineffective by skid trails or tree removal, new fence locations would be identified on a sale area basis. Fences would be constructed as necessary to ensure allotment rotations are in compliance with individual Allotment Management Plans and Annual Operating Instructions.
Protect Improvements
Protected improvements such as fences, gates, water developments, and recreation facilities (ski yurts, Trujillo Meadows water system) will be identified on sale area maps or in fuel treatment areas during harvest or treatment activities. Damaged improvements will be repaired or replaced, depending upon the amount of damage.
Potential hazard trees within 2 tree lengths of the Trujillo Meadows Campground well head,other water system components, or other improvements will be cut and removed.

Action
Hazard Trees/WUI Thinning
Hand felling of hazard trees is permitted in the WIZ. Trees shall be directionally felled and may be left in place to maintain or improve stream and riparian health. If necessary, felled trees may be stabilized to prevent movement. The Forest timber sale or contract administrator shall consult the Forest hydrologist or wildlife/fish biologist prior to granting approval to remove hazard trees from WIZ areas.
Any hazard tree, and associated slash, cut and lying within 100 feet upstream of a perennial or intermittent culvert/bridge crossing and within 25 feet from the stream edge that has the potential to obstruct the crossing shall be stabilized, removed, or moved at least 50 feet upslope away from the stream.
Felled hazard trees and slash shall be removed from roadside ditches and culverts, including removing from cross drains and sediment traps.
Felled hazard trees may be removed from stream corridors or riparian areas with Forest Service approval when they create unacceptable fuel loading; fail to meet visual objectives; or create unacceptable limits to human, livestock, or wildlife movement.
Hazard trees shall not be skidded across perennial or intermittent stream channels.
If hazard trees need to be removed from WIZ areas, use at least one-end suspension and felled in a way that protects vegetation from damage.
If chipping/grinding or other mastication method is used to treat understory fuels in WUI areas, slash shall not cover more than 50% of ground surface and depth shall not exceed 4 inches to minimize impacts to understory vegetation. Mastication equipment will not be used in WIZ areas.
If WUI thinning areas intersect a WIZ, hand thinning with chainsaws may be used. Hand piles will be located at least 50 feet upslope from perennial or intermittent streams or riparian areas and outside of the channel/swale for ephemeral drainages.
Soil and Water Protection
If whole tree yarding is used, limbs and/or tops shall be returned to the unit if 15% or more of the unit has exposed mineral soil; this material shall be distributed in areas primarily comprised of bare mineral soils.
Operate heavy equipment for land treatments only when soils are dry, soil moisture is below the plastic limit, or protected by at least 1 foot of packed snow or 2 inches of frozen soil.
Reuse existing skid trails and landings whenever practical
Skid trail locations will be agreed to by the Forest Service in advance of construction; spacing will be approximately 100 feet apart, allowing for topographic variation and skid trail convergence; skid trails will be waterbarred at least every 100 feet on gradients greater than 20 percent, otherwise where needed depending on slope and ground conditions as per BMPs; slash will be placed on main skid trails as needed to control erosion
Skidding equipment will generally be restricted to slopes <35%.
During project implementation, temporary roads will be outsloped, covered with slash (when needed), and blocked to vehicle access after the harvest season and before onset of the wet season.
Units with an existing detrimental soil disturbance level ≥12% will be treated as necessary to ensure post-treatment forest plan compliance, as determined by Forest Soil Scientist. ***Detrimental disturbance levels will be brought within the 15% standard through post-harvest subsoiling/ripping of primary skid trails, landing, and/or temporary roads to a depth of 12 to 24 inches and seeded or covered with slash after harvest, as needed. If harvested, these treatments will occur on units 1, 2, 6, 7, 11, and 20. It will also include any other units which are determined to exceed 15% detrimental disturbance after harvest.***
Temporary stream crossing structures (i.e. culverts, bridges, etc.) will be designed to provide for passage of flows and sediment, withstand expected flood flows, and allow free movement of resident aquatic life. Upon project completion, remove all temporary crossings, restore the channel morphology, and revegetate channel banks.
Slash piles and landings shall be located at least 50 feet (hand piles) or 200 feet (machine piles) from perennial streams, lakes, ponds, wetlands, or riparian areas.
A 100 foot no timber harvest buffer has been established along both sides of all intermittent and perennial stream channels, wetlands, ponds, or lakes. No heavy equipment will operate within this buffer except at designated crossings, unless authorized by the Forest Service where site-specific conditions would minimize stream and riparian impacts.
No timber harvest would occur in the channel/swale of ephemeral channels; Harvest may occur outside the channel, but no skid trails or mechanical disturbance would be permitted within 25 feet of both sides of the channel.
Hydrology, soils specialists, or their designees will inspect harvest units for seepages or riparian areas. Where found, these features will be protected through sale marking and layout; a 100 ft. no-harvest or skidding buffer will be maintained from the edge of all wetlands.
All roads (existing, new temporary, or old non-system) used for the project will be evaluated to identify and correct erosion or sediment problems. Additional cross drains or other standard measures will be used as appropriate to

Action
divert any road drainage into buffer/filter strips and minimize road drainage into steam channels.
Existing vegetation on cut and fill slopes would be retained as much as possible to limit sediment movement away from road.
Where existing roads will be reconstructed within 100 feet of intermittent or perennial streams, hydrology, soil specialists or their designees will be consulted to ensure sediment sources are disconnected from stream channels. If necessary, hardening, filter fence, straw wattles, timber slash windrows, or other measures will be used as appropriate to prevent sediment from entering a stream course.
Following logging and/or reforestation operations, all temporary roads used for this project will be closed and rehabilitated.
Scenic Resources
Visible stumps within the immediate foreground (0-100 feet) of FSRs 118, 118.1C, and Trujillo Meadows campground should be cut as close to the ground as practicable, a maximum stump height of 6 inches is recommended.
Avoid creating open linear corridors when removing hazard trees along roads, fences or other linear infrastructure; vary corridor width considering natural vegetation patterns and topography to blend treatments into local landscape.
Logging activities will not occur within 200 feet of the Continental Divide National Scenic Trail.
Landings or log decks will not be approved within 100 feet of ski yurts and logging slash will be removed in this area to the extent feasible.
Vegetation Protection/Biodiversity/Regeneration
In all salvage stands that exceed 50 percent removal of overstory spruce, reforestation surveys will be conducted, and if the survey indicates that Forest Plan stocking Standards will not be met, these stands will be artificially reforested to meet or exceed Forest Plan Standards.
To protect soil, leave trees, and advanced regeneration, tractor skid trails will be located and approved in advance of falling and logs will be skidded with the leading end free of the ground to reduce ground disturbance.
Protect existing aspen clones from damage and encourage clone expansion by removing encroaching conifers within a tree height of the mature aspen stems.
Trees with known active bird nests, any cavities, or those otherwise marked as wildlife trees will be designated for retention.
Retain all live/uninfested trees in salvage units, except for trees that need to be removed for operational/safety purposes.
Effects to understory vegetation and dense horizontal cover will be minimized to benefit snowshoe hare and lynx by identifying skid trail locations away from dense understory and spacing skid trails at least 100 feet apart, allowing for topographic variation and skid trail convergence; Incidental damage will be limited to a maximum of 30% of DHC.
Place landings in open areas if available, to protect understory.
Retain patches of overstory trees with dense understory.
Leave sufficient trees or retain existing large woody debris (a minimum of 10-15 tons per acre in spruce fir) on harvested sites to retain moisture, trap soil movement, provide microsites for establishment of forbs, grasses, shrubs and trees, and to provide habitat for wildlife.
Retain a minimum of 4 spruce snags per acre in various conditions of decay and distribution. Retain the largest snags possible with those > 11 inches dbh being most desirable. Retain all soft snags unless they are a safety hazard.
Seeding of disturbed sites would utilize a native subalpine grass mix and application prescriptions.
Public Safety
Roads used for vegetation treatment and log haul would be maintained in accordance with the contract requirements. Temporary traffic control in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) would be utilized for roads open to public motor vehicle use.
Notify the public of logging and/or burning activities through media such as local newspapers, radio, and the Forest website.
Caution signs notifying public of logging activities will be prominently displayed at start of all open roads and all junctions.
All gated roads will remain closed during harvest activities.
Dust abatement will be required on FSR 118 during July and August, as needed.
Hazard trees up to 2.0 tree heights will be removed along open roads and roads used for project implementation. Hazard trees will be removed within 2 tree heights of ski yurts.

Action
Heritage
The Discovery and Education stipulation below will be emphasized in areas with large aspen to avoid and protect undocumented arborglyphs.
Any new road construction or improvements not previously analyzed within this environmental analysis will require a review and potential inventory by Forest Service archaeologists.
All persons associated with operations under this authorization must be informed that any objects or sites of cultural, paleontological, or scientific value such as historic or prehistoric resources, graves or grave markers, human remains, ruins, cabins, rock art, fossils, or artifacts shall not be damaged, destroyed, removed, moved, or disturbed. If in connection with operations under this authorization any of the above resources are encountered, the proponent shall immediately suspend all activities in the immediate vicinity of the discovery that might further disturb such materials and notify the Rio Grande National Forest authorized officer of the findings. The discovery must be protected until notified in writing to proceed by the authorized officer (36 CFR 800.110 & 112, 43 CFR 10.4).

2.4 Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. These alternative(s) were considered, but dismissed from detailed consideration for reasons summarized below:

1. **Remove hazard trees only to protect infrastructure** – this alternative would not meet the Purpose and Need for the project for recovering the value of wood products or accelerating the rate of forest recovery to meet the long term desired conditions.

2. **Use trap trees to reduce beetle populations** – the epidemic population levels in the vicinity would make this technique ineffective for protecting residual trees. If suitable trees are available, beetles from surrounding areas are likely to find them.

2.5 Comparison of Alternatives

This section provides a summary of the effects of implementing each alternative. Information in the tables is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2-2 provides a comparison of the alternatives by issue statement followed by a brief summary of the effects discussions as related to the issues and table 2-3 provides a comparison summary of effects by resources as described in chapter 3.

Table 2-2. Comparison of alternatives by issue statement.

Issue	Indicator(s)	ALTERNATIVES								
		1 No Action			2 Proposed Action			3 Limited Action		
Issue 1-*Spruce beetle populations have exceeded endemic levels and may have moved forest stands away from Forest Plan Desired Conditions of protecting and promoting forest products, while peretuating landscape diversity*	Acres, distribution, and species composition of stands regenerated to desired stocking levels within 5 years after harvest	N/A			2,498			1,549		
	Tons/acre of large diameter fuels removed Potential fire severity	0 High			32 Decreased			32 Decreased		
	Acres salvaged	469[1]			2,498			1,549		
	Volume of commercial forest products recovered.	0			40,000 to 60,000 CCF 20-30 MMBF			30,000 to 40,000 CCF 12-20 MMBF		
Issue 2 *-- Project activities may impact watershed condition, water quality, and site productivity by increasing soil compaction, erosion, sedimentation, and altering water flows.*	Total acres treated	0			2,498			1,793		
	Percent area surface disturbance by watershed[A,B,C]	***A***	***B***	***C***	***A***	***B***	***C***	***A***	***B***	***C***
		0	0	0	9.4	2.6	1.4	6.07	1.41	1.87
	% increase in connected disturbed area [A,B,C]	***A***	***B***	***C***	***A***	***B***	***C***	***A***	***B***	***C***
		0	0	0	13	8	0	0	8	0
	Miles of old, non-system roads re-opened.	0			7.5			4.3		
	Miles of new temporary road construction.	0			0.8			0.1		
	Miles of road maintenance.	3.8[2]			30.8			20.7		
Issue 3- *Project activities may impact lynx habitat diversity.*	Total acres of suitable lynx habitat affected in the LAU.	0			1,983			1,352		
	Acres of incidental impacts to dense horizontal cover.	0			99			43		
	Acres of suitable habitat converted to stand initiation structural stage (SISS)	0			1,291			942		

[1] Firewood cutting of standing dead trees is permitted within 300 ft. of open roads. A value of 150 ft. was used to estimate acres affected, since many areas are not accessible due to topography and not all acres adjacent to open roads are forested.
[2]NFSR 118 is maintained annually, other open roads are usually maintained at 5 to 7 year intervals.
[A]Headwaters Rio de Los Pinos; [B]Toltec Creek-Rio de Los Pinos; [C]Wolf Creek

Alternative 1 – No Action

Issue 1: This alternative would not meet the concern expressed by this issue. Existing forest conditions would persist, which would consist of forested stands with an increasing numbers of dead trees due to spruce beetle activity. Long-term potential to meet Forest Plan desired conditions and many objectives for the analysis area would not be met. The short term potential to produce commercial forest products from these lands designated for that purpose in the Forest Plan would not occur. Commercial timber products would not be produced for approximately 150 years. Reforestation activities to ensure forest stocking and improve the potential to diversify vegetation composition in this landscape would not occur. Dead trees would continue to accumulate and fall over time, increasing the potential for a high severity wildfire and reduce options for fire suppression due to concerns for fire fighter safety, should a

fire start. Large numbers of dead trees would also increase the potential for damaging existing infrastructure.

Issue 2: This alternative would best meet this issue, at least in the short-term. No additional ground disturbance would occur. The continuing spruce mortality could alter water flows, but this would not be expected to impact streams in the analysis areas, since overall stream health is good and streambanks are stable. Reduction in transpiration as spruce die could potentially increase water quantity in heavy precipitation years. Standing and down trees would continue to intercept precipitation and understory vegetation would release as water and light increases. Compacted areas that may be affecting site productivity would continue to improve very slowly over time. As trees fall and fuel loading increases, the potential for a high severity fire increases, should a fire occur. A high severity fire would likely be detrimental to both watershed condition and soils.

Issue 3: This alternative would best meet this issue, at least in the short-term. The lack of additional disturbance to vegetation would reduce potential impacts to the Canada lynx and snowshoe hare. The changing habitat conditions caused by the spruce beetles would favor some wildlife more than others. Red squirrels, an important secondary lynx prey, that depend on cones for food could be adversely affected. There would be minor impacts to existing understory seedlings and saplings from natural blowdown as dead trees fall. Should a large wildfire occur, it would be detrimental to important habitat components for many wildlife species including Canada lynx and snowshoe hare, their primary prey.

Alternative 2 – Proposed Action (*Preferred Alternative*)

Issue 1: This alternative would contribute the most to meeting the concerns expressed by this issue. It proposes to implement salvage harvests to recover the value from dead and dying spruce on up to 2,498 acres from lands designated for this purpose under the Forest Plan. The opportunity to harvest these trees would meet the intent of the desired conditions and many objectives of the Forest Plan for providing commercial forest products and supporting local economies. This alternative would also provide the opportunity to facilitate forest stand regeneration and diversity by both artificial and natural regeneration methods across the most acres. Removal of a portion of the dead and dying trees on the salvaged acres would also preempt the eventual buildup of large amounts of down wood fuels that could contribute to a high severity wildfire and likely allow for more suppression options by fire fighters, if a fire started. Fuel reduction treatments and hazard tree removals would help reduce risks to adjacent private property and protect existing infrastructure.

Issue 2: Under this alternative, watershed condition would remain good. Best Management Practices (BMPs) and other Project Design Criteria (PDC) would protect the Water Influence Zone (WIZ) and water quality. Following implementation, site productivity would meet Forest Plan Standards. Road maintenance would fix areas where active erosion is creating sediment near streams. However, re-opening decommissioned road 118.1A could have water quality concerns, if PDC and BMPs are not carefully adhered to. Harvesting of dead trees may potentially increase water quantity and flows in years with heavy precipitation though remaining live trees, young trees, and understory vegetation would lessen increases. Since stream and stream banks are healthy, any increases in water should not cause adverse effects. Increases in compaction would be minimized by re-using skid trails and landings from previous harvests where possible, and where necessary, subsoiling would be implemented following harvest to ensure forest plan standards are met. Erosion and sedimentation would be minimized by PDC; streamside buffers would minimize potential for sediment to enter streams. This alternative would have to most potential to decrease the potential effects of a high severity wildfire, should one occur, by preempting the accumulation of large numbers of down trees.

Issue 3: This alternative would have the most potential impacts to Canada lynx and some of other varieties of wildlife evaluated, since it proposes the most acres of disturbance by harvest and related

activities. This alternative would have the most impacts to acres of Dense Horizontal Cover (DHC) important to lynx and other wildlife and would also change the most acres into a temporarily unsuitable Stand Initiation Structural Stage (SISS). Reforestation activities on harvested acres to ensure forest re-stocking would benefit lynx and many other species of wildlife over the long term. PDC would help minimize damage to understory vegetation and retain other structural elements which would help reduce adverse effects, but the temporary loss of DHC in salvage and Wildland-Urban interface areas would reduce the amount of high quality winter snowshoe hare habitat in the analysis area; the effects would still be within those analyzed under the Southern Rockies Lynx Amendment (SRLA) to the Forest Plan.

Alternative 3 – Limited Action

Issue 1: This alternative would contribute to meeting the concerns expressed by this issue, though to a lesser extent than Alternative 2. It proposes to implement salvage harvests to recover the value from dead and dying spruce on up to 1,549 acres from lands designated for this purpose under the Forest Plan. The opportunity to harvest these trees would meet the intent of the desired conditions and many of the objectives in the Forest Plan for providing commercial forest products and supporting local economies. This alternative would also provide the opportunity to facilitate forest stand regeneration and diversity by both artificial and natural regeneration methods, but on fewer acres than Alternative 2. Removal of a portion of the dead and dying trees on the salvaged acres would also help preempt the eventual buildup of large amounts of down wood fuels that could contribute to high severity effects from wildfires and likely allow for more suppression options by fire fighters, if a fire started. However, unharvested areas could result in additional fire behavior complexities.

Issue 2: This alternative would have fewer potential impacts to watersheds and soils due to less surface disturbance. Fewer temporary roads (including decommissioned roads) would opened and in need of rehabilitation. Watershed condition would remain good. Best Management Practices and other Project Design Criteria (PDC) would protect the Water Influence Zone (WIZ) and water quality. Erosion and sedimentation would be minimized by PDC; streamside buffers would minimize potential for sediment to enter streams. Road maintenance would fix most areas where active erosion is creating sediment near streams. Harvesting of dead trees may potentially increase water quantity and flows in years with heavy precipitation though remaining live trees, young trees, and understory vegetation would lessen increases. This alternative would have mixed effects since more areas would remain unharvested, however since stream and stream banks are healthy, any increases in water should not cause any adverse effects. Following implementation, site soil productivity would meet Forest Plan Standards. Increases in compaction would be minimized by PDC such as re-using skid trails and landings from previous harvests where possible, and where necessary, subsoiling would be implemented following harvest to ensure forest plan standards are met.

Issue 3: This alternative would have fewer impacts to Canada lynx and the some of the other varieties of wildlife evaluated, since it proposes fewer acres of disturbance by harvest and associated activities. This alternative would retain additional acres of DHC and reduce the number of acres that left in a temporarily unsuitable Stand Initiation Structural Stage (SISS). Reforestation activities would occur on fewer harvested acres to ensure forest re-stocking that would benefit lynx and many other species of wildlife over the long term. PDC would help minimize damage to understory vegetation and retain other structural elements which would help reduce adverse effects, but the temporary loss of DHC in salvage and Wildland-Urban interface areas would reduce the amount of high quality winter snowshoe hare habitat in the analysis area; the effects would still be within those analyzed under the Southern Rockies Lynx Amendment (SRLA) to the Forest Plan.

Table 2-3. Comparison of alternatives by resource area.

Resource and Unit of Measure	ALTERNATIVES		
	1 - No Action	2 - Proposed Action	3- Limited Action
Forested acres NOT treated in analysis area	2,447	51	898
Acres Treated			
Salvage	469[a]	2,498	1,549
WUI Fuel Treatments	0	171	171
Pile burning	0	31	24
Volume of commercial wood products recovered	0	20-30 MMBF 40,000 - 60,000 CCF	15-20 MMBF 30,000 – 40,000 CCF
Hazard tree removal – infrastructure protection	As needed	Up to 2.0 tree heights to protect infrastructure	Up to 2.0 tree heights to protect infrastructure
Acres Regenerated			
Planted Engelmann spruce	0	650	170
Aspen sprouting	Minor	20	20
Residual seedlings/saplings only	2,447	1,828	1,359
Road System (miles)			
Open NFS roads used & maintained	3.8[b]	12.5	10.9
Closed NFSRs maintained	0	5.0	4.9
NFSRs decommissioned roads-reopened & used	0	5.8	0.6
New temporary road constructed	0	0.8	0.1
Old Non-system roads re-opened	0	7.5	4.3
--- WATERSHED and AQUATIC RESOURCES --- Percent Disturbance by Watershed			
Headwaters Rio de Los Pinos (130100050201)	0	9.4	6.07
Toltec Creek-Rio de Los Pinos (130100050203)	0	2.6	1.41
Wolf Creek (130201020203)	0	1.93	0.94
7th level HUC of Concern 13010005050101	0	11.7	0
--- SOIL RESOURCES ---			
Total acres treated	0	2,498	1,549
Acres of Units ≥12% disturbance requiring subsoiling	0	117	48
---WILDLIFE---			
Threatened, Endangered, Proposed (5 species; 3 species: No habitat)	Lynx – No Effect Wolverine – No Effect	Lynx - May Affect; Likely to Adversely Affect. Wolverine – no jeopardy	Lynx - May Affect; Likely to Adversely Affect. Wolverine – no jeopardy
Sensitive Wildlife Species (29 species;22 species No habitat)	7 species- No Impact.	7 species -May Impact individuals, but not affect population viability.	7 species -May Impact individuals, but not affect population viability.
Management Indicator Species (9 species; 4 species No habitat)	5 species -No discernible change in population levels	5 species-– No discernible change in population levels	5 species-–No discernible change in population levels.
Neotropical migratory land birds	No Effect	Minor disturbance and/or displacement.	Minor disturbance and/or displacement.
---STREAMS AND AQUATIC HABITAT---			
Potential risk to stream & riparian health	Low	Low to Moderate FSR 118.1A re-opening	Low

Table 2-3. Comparison of alternatives by resource area.

Resource and Unit of Measure	ALTERNATIVES		
	1 - No Action	2 - Proposed Action	3- Limited Action
---SCENIC RESOURCES ---			
Scenery Integrity Objectives	Mod. & High	Moderate	Moderate
--- SENSITIVE PLANT SPECIES ---			
Sensitive Plant Species- 5 species with potential habitat	No Impacts	No Impact to 4 species; 1 species -May Adversely Impact Individuals, no trend toward loss of viability	No Impact to 4 species; 1 species -May Adversely Impact Individuals, but no trend toward loss of viability
--- RANGELAND RESOURCES and NOXIOUS WEEDS ---			
Risk of Noxious Weed establishment / expansion	Low	Moderate	Moderate
--- RECREATION ---			
Continental Divide National Scenic Trail	No effect	Low	Low
Recreational Impacts - winter	Some effect – falling & down trees	Less effect in longer term	Mixed effects – less in harvested areas; some in non-harvest areas
--- SOCIAL & ECONOMICS ---			
Net Present Value	-$250,000	-$533,712	-$410,924
Benefit/Cost Ratio	0	0.42	0.36
Benefits to the San Luis Valley	Negative	Some Benefit	Some Benefit
--- HERITAGE RESOURCES ---			
Risk to Identified & Unidentified Cultural Resources	No risk	Very low risk	Very low risk
Osha plant	No effect	Longer term- positive effect	Longer term-some positive effect
--AIR QUALITY--			
Impacts to local air quality	No effect	Minor – localized, short term	Minor – localized, short term

[a] Firewood cutting of standing dead trees is permitted within 300 ft. of open roads. A value of 150 ft. was used to estimate acres affected, since many areas are not accessible due to topography and not all acres adjacent to open roads are forested.
[b] NFSR 118 is maintained annually, other open roads are usually maintained at 5-7 year intervals.

2.6 Monitoring Measures

Monitoring is gathering information, observing processes, and examining the results of management activities to provide a basis for evaluation. Monitoring is done at both the project and Forest Plan level. The Cumbres Project contains project specific monitoring. It also includes Forest Plan monitoring and evaluation items. Monitoring includes implementation monitoring and evaluation to ensure that Standards and Guidelines are being incorporated during the project activities, as well as effectiveness monitoring and evaluation to determine whether project objectives are being met and if Project Design Criteria (PDC) are effective. Below are listed the monitoring measures that were recommended for incorporation into this project.

Timber Resources

Objective: In conjunction with other resource specialists, ensure that all resource protection measures in the Decision are included in the timber sale contract and properly implemented.
Method: A detailed review and monitoring process will be utilized to ensure protection measures are incorporated and implemented.

- **Action:** Timber sale contracts will be reviewed and certified by the District Ranger to ensure conformance with the Decision prior to advertisement of timber sales, ensuring that required protection measures are included in the timber sale contract.

- **Action**: Implementation monitoring will be conducted through harvest inspections. As a routine part of project implementation, contract administrators monitor harvest and construction activities to ensure that project elements and Forest Plan Standards and Guidelines (S&Gs) are followed as designed.
- **Action:** The Timber Sale Administration team is responsible for administering the contract. If required, the team will initiate action to repair resource damage and suspend operations until problems have been corrected.

Objective: Ensure that the treated stands are reforested to at least Forest Plan standards.
Method: Stocking surveys will be conducted the first, third and fifth year (if necessary) after project implementation to evaluate regeneration distribution, species mix, and trees per acre to ensure that the areas are successfully reforested.

- **Action:** If existing regeneration is inadequate, artificial planting would be implemented.

Wildlife

Objective: Evaluate whether Forest Plan S&Gs and project specific wildlife design criteria are being implemented. To examine if a need exists to modify specific wildlife design criteria for future projects.
Method: Perform site inspections during and/or following the vegetative management activities to determine compliance with project design criteria. Items important to monitor include:

- ✓ Snag numbers, species and size
- ✓ Impacts to understory vegetation
  - Percentage of damage to Dense Horizontal Cover *
  - Percentage of damage to developing understory *
  - Skid trail designation
  - Landing placement
- ✓ TES species monitoring
- ✓ Timing of project activity
- ✓ Amount of large woody debris
- ✓ Riparian area buffers

* Post-harvest monitoring will be implemented to assess actual incidental damage to the understory. If damage is substantially different (+/- 50 percent of the original acreage estimate) than the 30% being estimated, impacts to lynx habitat will be re-evaluated in an addendum to the Biological Assessment. Post-harvest monitoring will also be useful for evaluating future vegetation management projects.

- **Action:** Take corrective action as needed to meet Forest Plan Standards and Guidelines. Consult with the necessary managers as needed to take corrective measures if necessary.

Soil Resources

Objective: Ensure that PDC are being properly implemented and Forest Plan S&Gs are being met in regards to soils.
Method: Soil moisture conditions will be monitored during harvest activities by Forest Service personnel.

- **Action:** Ensure that timber harvesting operations are being suspended when soil conditions are too wet to operate and would result in resource damage.

Method: Use accepted soil monitoring techniques to assess overall cumulative soil impacts after harvest is completed.

- **Action**: Conduct traverses, spot soil sampling, or other soil management handbook methods to assess soil productivity and amount of subsoiling needed on a subgroup of units that are currently above 12 percent detrimental soil disturbance within 1 year of harvest. Complete any rehabilitation measures needed within 5 years of harvest.

Watershed Resources

Objective: Ensure that PDC are being properly implemented and that Forest Plan Standards and Guidelines are being met in regards to stream health.
Method: Conduct site inspections along affected streams in the project area during and after vegetation management and road activities to assess changes in stream conditions.

- **Action:** Additional monitoring of stream channels would be focused on sub-watershed 13010005050101 to verify PDC effectiveness and assess any changes in stream conditions.

Method: Inspect road segments near and at stream crossings after reconstruction/maintenance operations have been completed. Inspections will occur prior to, during, and following vegetation management activities.

- **Action:** Work with the Timber Sale Administration team to ensure that contract provisions are being implemented. Implement additional mitigation if necessary to minimize sediment or other negative impacts to streams.

Scenic Resources

Objective: Ensure that PDC are being properly implemented and that Forest Plan S&Gs are being met in regards to scenic resources.
Method: Conduct site inspections to ensure prescribed PDC are being implemented.

- **Action:** Visually review stump heights along NFSRs 118, 118.1C and near Trujillo Meadows CG to ensure they meet objectives. Work with Timber Sale Administration team to ensure landing locations are away from yurts and unit layout meets visual objectives.

Travel Management

Objective: Survey area roads to determine if logging has removed travel barriers and to determine if illegal off-highway vehicle use is occurring as a result of treatments.
Method: Periodic visual inspection

- **Action:** Install additional signs, barriers, and increase law enforcement efforts, as appropriate.

Noxious Weeds

Objective: Ensure that PDC are effective and that no additional noxious weed infestations occur within the project area.
Method: Site inspections during and after project implementation to ensure that design criteria are fully implemented. Perform annual surveys for noxious weeds in disturbed areas for up to 5 growing seasons to ensure new weed populations are not being established and if any existing populations are discovered, they are controlled and do not spread.

- **Action:** Treat identified noxious weeds in a timely manner as part of the forest noxious weed treatment program.

Range Resources

Objective: Ensure that range PDC are effective.
Method: Site inspections during and after project implementation to ensure that design criteria are fully implemented.

- **Action:** Perform site inspections during and after the project is complete to ensure livestock are not impacting regeneration within the project area and fences are still functional.

- ♦

Heritage Resources

Objective: Protect known and undiscovered heritage resources.
Method: Newly constructed temporary roads should be monitored for erosion and potential impacts to undocumented heritage resources.

- ♦ **Action:** Appropriate action will be determined and implemented to protect affected heritage resources.

Objective: Facilitate completion of the multi-year *Osha* study by University of Kansas.
Method: Assist Kansas University with the *Osha* study to evaluate changes in plant abundance due to logging or other disturbance activities and plant collecting.

- ♦ **Action:** Support the monitoring of established study plots over the next 5 years to gauge potential effects to individual plants resulting from timber harvest activities and plant harvest activities.

CHAPTER 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter summarizes the existing conditions and the potential effects due to the implementation of alternatives. It also presents a brief summary of the scientific and analytical basis for comparison of alternatives presented in chapter 2. Each resource discussion addresses the following components: 1) Scope of the analysis; 2) Existing condition relating to each resource; 3) Direct and indirect effects by each alternative; and 4) Cumulative effects.

Based on CEQ definitions (40 CFR part 1508), direct effects are those which are caused by the action and occur at the same time and place. Indirect effects are caused by the action, but are later in time or further removed in distance, but are still reasonably foreseeable. Effects may be either beneficial or detrimental. Cumulative effects result from the incremental impacts of an action when added to other past, present, and reasonably foreseeable future actions regardless of who implements the action (Federal, non-Federal, or individuals).

A list of terms and definitions used in the analysis and a list of common acronyms is located in appendix A.

The analysis area is located on National Forest System lands designated for multiple-use. The transportation system in the Cumbres Analysis Area was constructed to allow access for recreation, timber harvest, range management, private land access, and fire suppression. Road construction occurred in stages beginning in the early 1950s. Trujillo Meadows Reservoir was constructed in 1955. The area is used for livestock grazing, developed and dispersed recreation, and to provide forest products. Most of the proposed harvest units have been harvested previously. The summary tables of past forest management activities are located in Appendix C.

Biological Resources

This section includes a summary of the analysis of potential effects on biological resources. Complete reports are located in the project record.

3.2 Forest Health

Scope of the Analysis

This section summarizes the forest health[4] conditions within the Cumbres project analysis area and the potential for the alternatives to affect forest health. The forest health analysis focuses primarily on the Engelmann spruce-subalpine fir (spruce/fir) dominated stands in the analysis area. Forested stands represent 69 percent of the land cover within the analysis area and are all of the spruce/fir forest type at elevations ranging from 10,000-10,800 feet. Other cover types represented include grasses/forb (24 percent), rock (4 percent), and shrubs (3 percent). Figure 3-1 shows the mapped dominant vegetation cover types in the area. Aspen is a minor component in the analysis areas and is found in scattered patches, primarily south and east of Neff Mountain.

[4] For the purposes of this analysis, forest health is defined by the Forest Plan, specifically as "A condition where biotic and abiotic influences on the forest (i.e. insects, diseases, atmospheric deposition, silvicultural treatments, harvesting practices) do not threaten management objectives for a given Forest unit now or in the future" (USDA Forest Service 1996, p M-9).

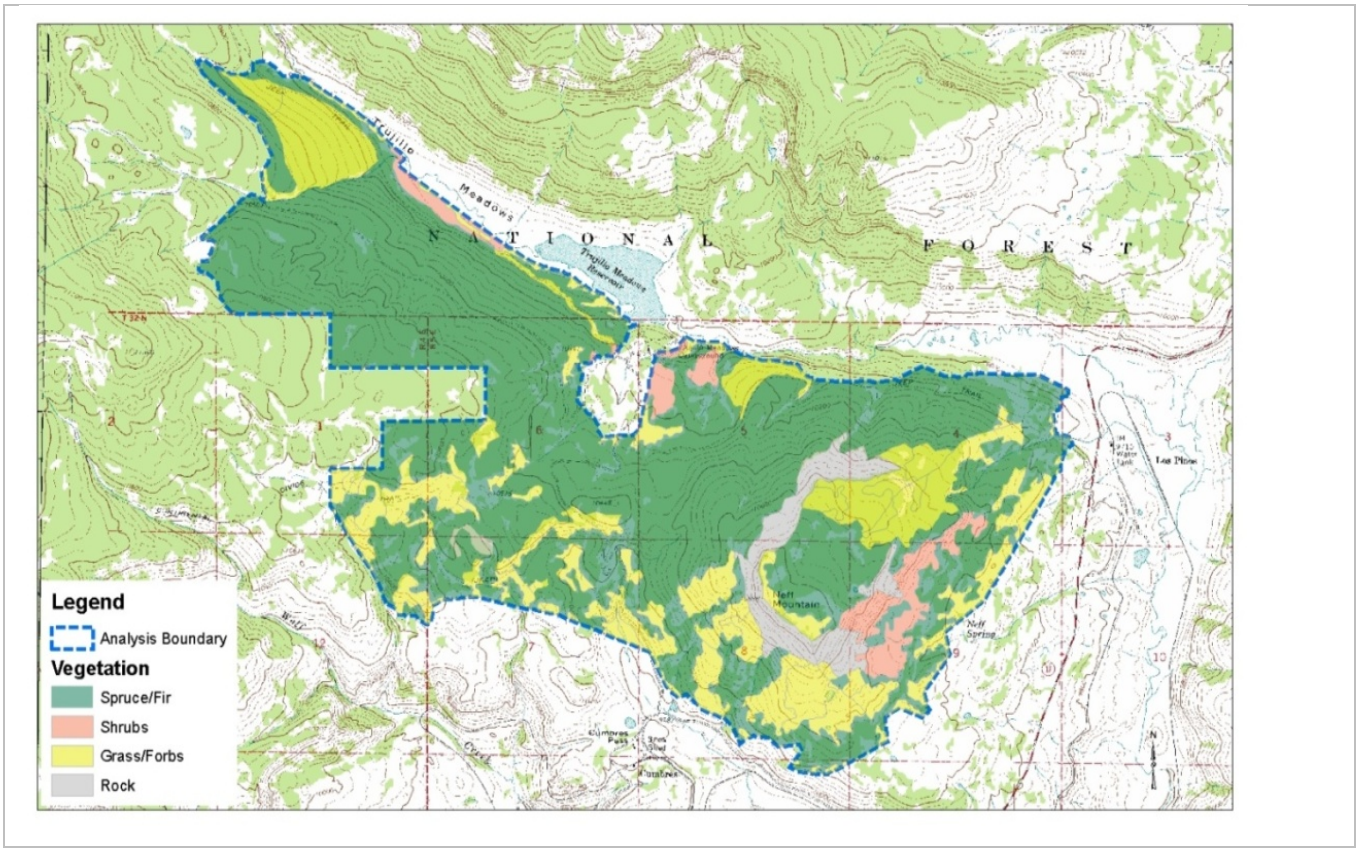

Figure 3-1. Dominant vegetation cover types, Cumbres project area (Source: FSVeg database).

Existing Conditions

This analysis will address forest conditions related to the interaction of human activity with four common biotic and abiotic influences that affect these stands: spruce beetle (*Dendroctonus rufipennis*), western spruce budworm (*Choristoneura occidentalis*), armillaria root disease (*Armillaria ostoyae*), and windthrow.

Influence 1: Spruce Beetle

The spruce beetle is a native insect to Colorado, generally occurring at endemic levels (Schmid and Mata 1996). In recent years, however, it has become the greatest impact on forest condition within the analysis area. Spruce beetles have also been responsible for substantial tree mortality across the Rio Grande National Forest. Like other bark beetles, these insects cause mortality in spruce trees by feeding upon the cambium, which is the growth zone directly underneath the bark.

The potential for an outbreak of bark beetles is determined by three primary factors: current bark beetle population levels, the susceptibility of individual stands, and weather patterns. The status of these driving forces reflects the currently large amount of spruce beetle activity on the Conejos Peak Ranger District. In order for a bark beetle outbreak to occur, there must be a sufficient beetle population to respond to favorable conditions. The extent of recent spruce beetle-caused mortality in the analysis area indicates that spruce beetle populations are at an epidemic level (Eager 2011). Stand conditions are also a primary determinant of bark beetle activity. Stands that are old and dense are generally more susceptible to bark beetles. In the case of Engelmann spruce, a risk rating system derived by Schmid and Frye (1976) documented that mortality as a result of spruce beetle activity is most likely to be initiated in stands that: a) consist of larger size classes, b) are more dense (more trees per acre), c) have a higher percentage of spruce and d) are located on highly productive sites. Stands in the Cumbres Project analysis area meet most of the

criteria for stands conducive to beetle activity. The susceptibility of high-risk stands can be attributed to large dense trees competing for sunlight and (more importantly) moisture. This "competition" for moisture is naturally more intense among older, denser stands of trees.

The Rio Grande National Forest experienced a severe drought within the early 2000s (Webb et. al. 2004). Low availability of moisture has generally reduced the tree's ability to resist bark beetle attack. The overall lack of moisture allowed spruce beetle populations to increase, and has also increased the susceptibility of adjacent stands. For some insects, the end of the drought usually means the end of the outbreak. However, with mountain pine beetles and spruce beetles, once the beetles have killed a large number of trees and produced abundant offspring, their numbers may become so great that they can overwhelm even healthy trees (Romme et al. 2006). This phenomenon appears to be occurring on the Rio Grande National Forest (Eager 2011).

There was no evidence of significant spruce beetle activity occurring in the analysis area until fairly recently. Increased spruce beetle activity was noted in the local Wolf Creek drainage and Neff Mountain areas in 2003. A small salvage sale was implemented on Neff Mountain in 2004 and the *County Line Vegetation Management Project* was initiated the same year. Spruce beetle activity increased dramatically in the County Line area until 2010 and has spread into and across the analysis area from the west at epidemic rates. This activity has also coincided with population increases in the Neff Mountain area.

Human activity, specifically forest management, can provide both positive and negative feedback to a stand's resistance and resiliency to spruce beetle activity. On the positive side, management activities can increase stand resistance to beetle spread prior to an outbreak by influencing the size classes, density, and species composition: three of four factors in the Schmid/Frye risk rating. Stand resiliency can also be increased through these activities by establishing younger cohorts within the stand which are not susceptible to beetle infestation. Such treatments must be done proactively, but as noted above cannot always stem the tide of an epidemic beetle population. Management activity can also reduce beetle spread reactively through sanitation treatments or beetle trap trees. Sanitation treatments remove insect food sources and brood by taking out recently-killed trees and/or currently-infested trees. Trap trees are utilized to draw in an existing beetle population and remove them from the stand along with the logs. These treatments are generally applied when an increase in endemic population is observed and/or windthrow has been caused by a wind event.

Past timber management treatments within the Cumbres analysis area are listed in Appendix C. Past management activities did reduce the risk of spruce beetle affecting these stands under *endemic* populations, but could not protect against epidemic beetle populations and drought-related stress.

On the negative side, management activity can have the potential to increase spruce beetle activity, but only if it is affecting green spruce trees. Examples of this feedback include harvest-generated windthrow in the residual or adjacent stand or increased food sources by cutting, but not removing, live spruce trees (Schmid and Mata 1996). This sort of feedback can generally be addressed through prompt follow-up treatments, but it is important that the original treatment be carefully planned and properly executed.

Records from past timber management activities noted events of minor windthrow resulting from management activities. An increase of endemic beetle activity was also observed in 1985 as a result of the defaulted Flat Timber Sale which had down green timber and log decks. In both instances (windthrow and down green timber), sanitation/salvage treatment was utilized to minimize the feedback and no spruce beetle outbreaks were experienced. These events overlap with current beetle activity in space (location), but not in time and are unrelated to the current epidemic.

Field surveys were completed in 2010 and 2011 by Rio Grande National Forest timber personnel and Gunnison Service Center personnel. Spruce beetles were found throughout the analysis area in large numbers, increasing steadily from west to the east. In 2011, spruce infestation rates ranged from 90 percent in the west to 30 percent in the east; additional spot ground surveys in 2013 have indicated that most spruce in the project are currently infested (see table 3-1, Forest Management section). According to Forest Service Entomologist Tom Eager, mortality of every infested spruce tree is a near certainty because of the immense population of beetles present. Susceptible spruce trees currently not infested are also very likely to become infested for the same reason.

The dramatic increase in spruce beetle activity in the area highlights the severity of the prior drought conditions in this area and across the Forest, as well as extremely high spruce beetle populations to the west of the project. Various indicators of drought severity including water yields, fuel moisture content, and plant physiology indicators all set records in 2002. It is likely that these conditions facilitated the rapid increase in beetle population and activity when this outbreak first began. Prolonged drought conditions through 2006, further endangered the stands and promoted beetle population growth.

Large spruce beetle populations directly to the west of the analysis area are proving to be detrimental to these stands. Once a full-blown outbreak is underway, the huge beetle populations can engulf entire landscapes and kill practically all spruce. Such intense outbreaks are not unheard of. Landscape scale outbreaks of spruce beetle have been recorded throughout the range of spruce, including locations in Alaska, New Mexico and Utah as well as numerous examples in Colorado. On the Rio Grande National Forest, we have experienced these phenomena in the County Line, Burro-Blowout, Big Moose, and Black Mesa project areas. Due to the predominant presence of spruce stands within the analysis area, this outbreak is expected to have broad impacts across the landscape.

Influence 2: Western Spruce Budworm (WSBW)

WSBW is also a native insect to the analysis area, but it alters stand structure by defoliating host trees rather than attacking the tree's cambium. WSBW impacts a wide variety of hosts including Douglas-fir (*Pseudotsuga menziesi*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*) (Fellin and Dewey 1982). Spruce budworm alters stand structure by defoliating understory trees, predisposing larger trees to bark beetle attack, and by diminishing the available seed sources of the host species (Hadley and Veblen 1992). Generally, budworm outbreaks are most severe in dense, multi-storied stands as suppressed understory trees intercept budworm populations dispersing from overstory trees, thus making them more susceptible to defoliation damage and high mortality rates (Hadley and Veblen 1992).

There has been no evidence of past significant WSBW activity occurring within the analysis area. Minor amounts of activity have been noted in and around the area, but not to an extent that would affect tree vigor or form. Likewise, record from past timber management activities have not documented any concerns over budworm.

Past timber management activities may or may not have affected the current WSBW populations. The removal of some over-story trees with the past shelterwood preparatory cuts and shelterwood establishment cuts opened up stands and increased the dispersal distances of budworm populations from overstory trees to understory trees, increasing the likelihood of predation. Past clearcuts and overstory removal prescriptions eliminated the host trees for western spruce budworm, greatly decreasing budworm activity and limiting it to the stand periphery.

Recent stand data show WSBW has impacted some of the eastern units, although not to an extent that would affect tree vigor or form. These denser stands provide adequate habitat for larvae to disperse

downward through the canopy to understory trees and are at a slightly lower elevation than other sites. Overall, budworm is not considered a concern to forest health within this project.

Influence 3: Armillaria Root Disease

Armillaria root disease is also a native pathogen that is present in most spruce/fir stands in the Southern Rockies and usually results in scattered, isolated pockets of mortality and windthrow in older stands. Like western spruce budworm, *armillaria* may have contributed to increased susceptibility of some stands to spruce beetle within the analysis area.

There has been some evidence of past *armillaria* occurrence within the analysis area as would be anticipated, although management records did not documented concerns over it. A service trip report prepared by Entomologist Roy Mask and Forest Pathologist Jim Worrall also noted presence of armillaria within the adjacent *Trujillo Meadows Campground Vegetation Management Project*, although not extensively (Mask and Worrall 2011).

Past timber management activities may or may not have affected the occurrence of *armillaria* root disease within the analysis area. Partial cutting likely had multiple, conflicting influences on disease dynamics. On one hand, stumps may provide increased food to the pathogen and more energy to attack neighboring trees, but on the other hand, partial cutting can lead to increased vigor and resistance of residual trees (Mask and Worrall 2011). *Armillaria* root disease is believed to be at only endemic levels within the analysis area.

It appears through field reconnaissance that the *armillaria* root disease in the analysis area is likely at, or near, endemic levels. Overall, *armillaria* is not considered a concern to forest health within this project nor to be outside the range of natural occurrence. Scattered windthrow and tree stress caused by *armillaria* could have contributed to the buildup of spruce beetle populations within the analysis area.

Influence 4: Windthrow

Windthrow, also known as blowdown, are trees felled or broken off by wind. This event is common in spruce/fir stands, which are characteristically shallow-rooted. It can result from natural events alone, involving weather events and/or disease interplay, or can be precipitated by management activity.

There has been some evidence of recent minor windthrow within the analysis area, as well as record of past minor windthrow events, as noted. Wind risk within this area is rated from low to high, according to a stand's specific slope position and aspect.

Wind risk has been generally been decreased as a result of past management activities. These treatments have gradually opened up the stand structure and increased tree stability and wind firmness.

Evidence of recent windthrow pockets has been observed and single-tree windthrow events are anticipated each spring in high elevation spruce/fir stands. However, no large-scale events were observed at last survey, and windthrow is not considered a concern to forest health at present. Pockets of windthrow could have been a contributing factor to the overall build-up of spruce beetle within the analysis area, but were not a driving force of their success.

Evaluation of Existing Conditions- When evaluating these existing conditions of the analysis area in terms of forest health, it is important to understand what standard the conditions are being measured against. The Forest Plan definition of forest health is a condition where influences do not threaten management objectives for a given Forest unit now or in the future (text abbreviated and emphasized for clarity). With the definition, the standard for forest health is determined by the management objectives for the Management Area Prescription (MAP) under consideration. If the existing condition is in alignment with the objectives for the MAP, then forest health meets the standard. If the existing condition is not in alignment with the objectives for the MAP, then there is a disparity to be addressed. Some management MAPs within the Forest are intended for events to be heavily managed for certain goals, while other MAPs are intended to be very lightly management for other goals. This definition does not deny the benefits of natural processes, but tends to the overlap between natural processes and desired conditions.

Within the analysis area, units fall within two Management Area Prescriptions (MAPs) defined by the Forest Plan. The majority of the area falls within MAP 5.11- *General Forest and Intermingled Rangelands,* and the remainder falls within MAP 5.13- *Forest Products*. Within both of these prescriptions, forest insect or disease infestations are to be evaluated against the potential for loss of commercial forest resources, with management emphasis on protecting the commercial resources (USDA Forest Service 1996, p IV-26, p IV-28). When measured against this standard, a disparity exists concerning forest health.

Direct and Indirect Effects

Under all alternatives, units that currently have large beetle populations would continue to experience rapid, extensive mortality, most likely until most of the mature spruce component is killed. During intense beetle outbreaks, the outbreak ends only when the beetles deplete their host food supply. This scenario is expected to occur and to be duplicated in most stands that have any spruce beetle activity at all, assuming that the impacts of prior drought conditions continue. Even without continued drought, the currently elevated state of the spruce beetle population will likely persist in this area for some time. Due to current stand structure and conditions created by the spruce beetle; these areas will be either even-aged or two-aged, whether or not management activities are applied.

The spruce beetle outbreak currently extends beyond the analysis area boundary and into Wilderness areas, backcountry areas, and into other inaccessible or inoperable spruce stands within and adjacent to the analysis area. Relatively contiguous suitable spruce beetle habitat is present around the analysis area and it is reasonable to expect spruce beetle activity to continue to increase within the analysis area.

Alternative 1 – No Action

As mature stands are killed by spruce beetle, two influences will work together to shift species composition within the affected stands both now and into the future. First, the species-specific mortality would shift current overstory composition strongly toward subalpine fir, while the predominantly fir understory (advanced regeneration) would be released to grow. Second, the subalpine fir seed source would be sustained for continued propagation, while the Engelmann spruce seed source will be greatly diminished. This aggregate affect would favor current and future stands dominated by subalpine fir. This shift in both stand structure and species composition has been observed before and could last as long as 125 to 175 years (Schmid and Mata 1996). Units toward the eastern side of the analysis area may experience a limited expansion of aspen clones, although this will likely be regulated by ungulate browsing pressure.

Various effects on WSBW and *armillaria* root disease occurrence could result from these shifts in species composition. In the short-term (50 years), the death of overstory spruce would increase dispersal distance of budworm from remaining overstory fir trees, thereby reducing insect survival. The loss of overstory would also release the suppressed understory making the understory more resilient to WSBW. In the long-term (50+ years), future occurrence of WSBW could actually be increased in subalpine fir-dominated

stands as a preferred habitat develops. Subalpine fir is also less resistant to *armillaria* root disease than Engelmann spruce, which could potentially increase the future occurrence of *armillaria* root disease within the analysis area. Windthrow risk would be slightly increased for residual overstory trees in each stand due to the loss of wind protection.

Figure 3-2 shows the FVS (Forest Vegetation Simulator) representation of expected changes under No Action. As the mature stands are killed by spruce beetle, the structure and appearance of stands would also change drastically. The stands would become more open, with little canopy closure for the next 30 years. Post-outbreak canopy closure is expected to drop to about 17 percent before increasing again. Snags would increase, giving the landscape a grey tone. Such transition can be observed in the adjacent El Gato Salvage Sale, which has not yet been harvested. Averages of 50-60 snags/acre are expected to result from the spruce beetle epidemic within the next 2 to 3 years, maintaining horizontal cover within the stand. The forest structure would close in over the next 30-50 years, and an overstory would be re-established within the next 100 years.

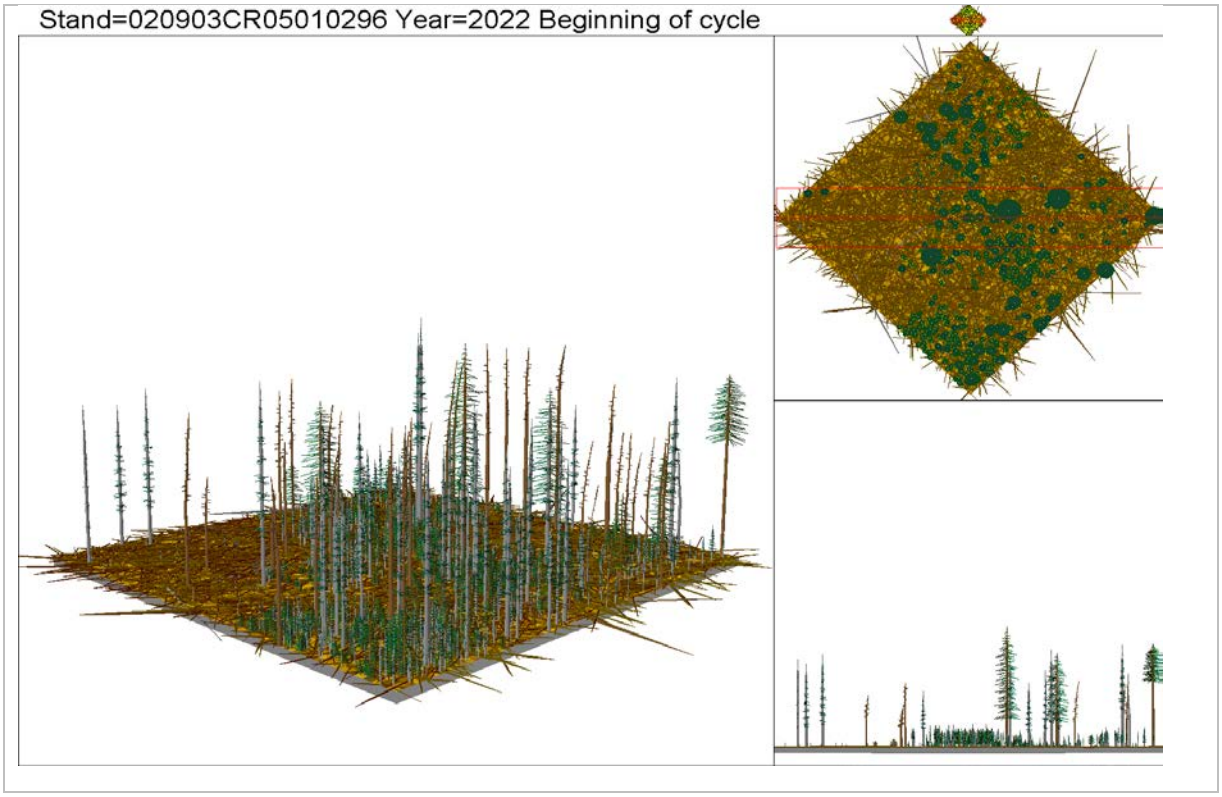

Figure 3-2. Forest Vegetation Simulation (FVS), 10 years post spruce beetle outbreak, Alternative 1.

The majority snags are expected to fall within the next 50 years, producing large fuel loads (coarse woody debris (CWD)). Moderate levels of coarse woody debris are desirable for soil development and regeneration establishment (shading), but excessive amounts of debris can diminish natural regeneration establishment (rooting) and increase burn severity, should a fire occur. Further discussion of CWD can be found in the Fire/Fuels section.

Under Alternative 1, firewood gathering would still occur along open roads and within permitted areas, on approximately 469 acres. Impacts upon forest vegetation and recovery are expected to be extensive within these areas, due to increased access needs and uncontrolled felling operations. These activities would

remain within the scope of the management objectives for the affected units, and impacted areas would still be re-established with forest vegetation.

Alternative 2 – Proposed Action

This alternative proposes to perform salvage operations on up to 2,498 acres through a variety of silvicultural systems. Salvage would include the removal of dead or infested trees that have been impacted by spruce beetles. It would have minimal impact on overall beetle numbers, but would provide opportunity for economic recovery of forest products, while allowing influence on the establishment of the new forest through the manipulation of structure, species composition mix, and the distribution and loading of CWD. These management activities would promote conditions within the future forest that would continue to be in alignment with the management objectives for the area. Salvage could potentially reduce the rate of spread of the beetles at the stand level, but it is not realistic to think that the proposed treatments would control the spruce beetle outbreak over vast areas adjacent to the treated units.

Because of the scale of the epidemic and resulting mortality, salvage harvesting within each affected unit would generally be extensive and the resulting stand structure would appear open as a result of removing an average of 50-60 dead and dying spruce per acre. Figure 3-3 shows and FVS simulations of post-harvest stand conditions. Post-treatment canopy closure is expected to drop to about 7 percent, before increasing again. A minimum of 4 snags per acre would be retained for wildlife habitat, as well as subalpine fir and any uninfested spruce. Forest structure would close in over the next 30 to 50 years, and an overstory would be re-established within the next 100 years. Future fuel loads (CWD) resulting from snag fall would be greatly reduced, but logging debris would still be evident within the stand. Windthrow risk of residual trees would be increased by the removal of the snag wind protection, particularly on southwesterly exposures. This risk has been partially mitigated by past management activities, but would still be anticipated. Although undesirable, this event would create good microsites for natural and artificial regeneration establishment and would not contribute toward any additional insect or disease outbreaks.

Under Alternative 2, artificial regeneration by planting Engelmann spruce would be planned for on approximately 650 acres. Actual planting acres would be determined through post-treatment evaluations based upon desired species composition, distribution, and stocking levels, in an effort to maintain landscape diversity in composition, structure, and function. Desired stocking levels would likely be higher than, but would not be less than, the Forest Plan restocking standards of 150 trees per acre.

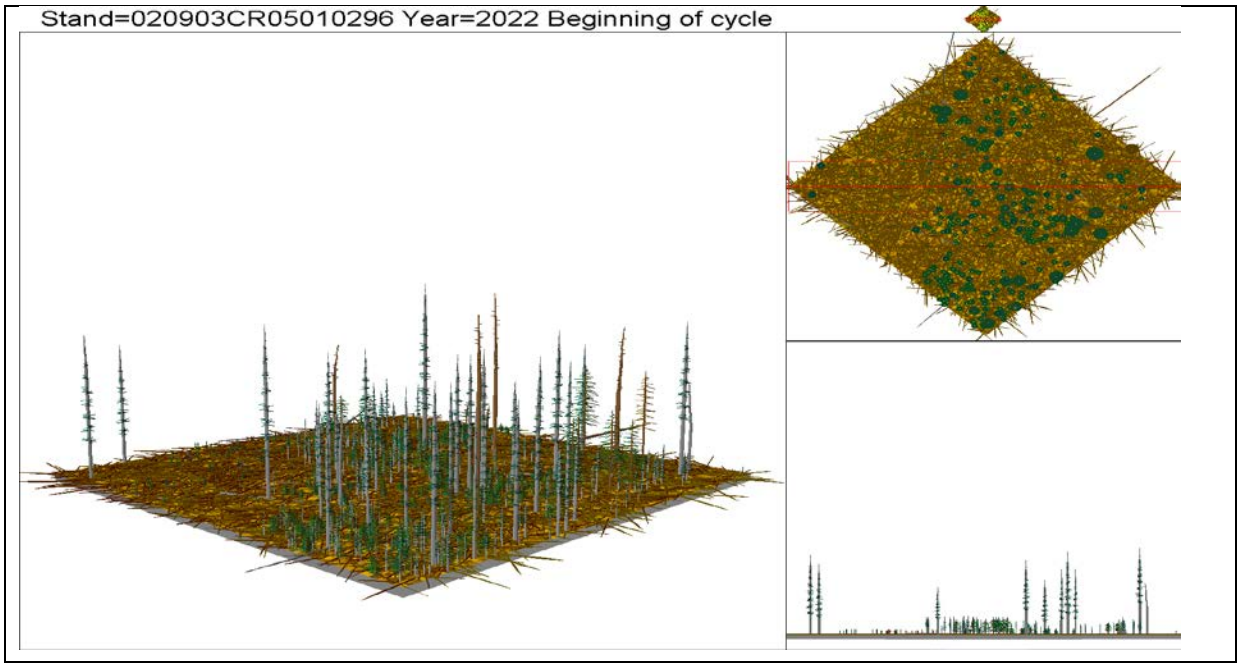

Figure 3-3. FVS depiction of a stand 10 years after salvage harvest and regeneration treatment.

Engelmann spruce is susceptible to *armillaria* root disease, but this disease usually does not affect the tree until it reaches later seral stages. Engelmann spruce shows greater resistance to *armillaria* than subalpine fir, which would otherwise be regenerated on these sites. Any increase in *armillaria* root disease following salvage harvesting would not be the result of removing beetle infested or beetle killed trees. Root systems of beetle-killed trees would not be affected in their suitability as a food base by removal of the stem. Project design criteria (PDC) for protecting existing regeneration and establishing new regeneration (chapter 2) would be applied to all action alternatives.

Alternative 2 also proposes hazard tree removal up to 2.0 tree heights of open roads, fences, private land, cabins or other infrastructure. The removal of hazard trees within this zone would have the same effect as the salvage harvest, but would also remove live trees prone to windthrow which could cause harm or damage infrastructure.

In addition, Alternative 2 proposes fuels treatment to improve defensible space in WUI areas up to 400 feet from adjacent private land or other structures on approximately 171 acres. These treatments would focus on thinning understory trees (<8" dbh) and shrubs, as needed, to modify potential fire behavior. The effects of this action on spruce beetle would be minor as the spruce beetles preferred habitat is trees greater than 8 inch dbh, although some trees as small as 4 to 5 inches are being infested and killed by spruce beetle. Removing some of the dense smaller trees, especially subalpine fir, would help reduce spruce budworm host trees, thereby making these treated areas less susceptible to the insect.

Part of the design for Alternative 2 is to set aside 97 acres for public firewood gathering, where no commercial harvest would occur. Impacts upon forest vegetation and recovery are expected to be greatest within these units, due to increased access needs and uncontrolled felling operations. These activities and effects, however, would be identical to the firewood gathering performed under Alternative 1, except that vehicles could be allowed further off open roads within these specific areas. Activities would remain within the scope of the management objectives for the affected units, and these areas would still be re-established with forest vegetation over time.

Alternative 3 – Limited Action

Like Alternative 2, this alternative would designate units where dead and dying Engelmann spruce are removed for the primary purpose of recovering the economic value of dead and dying trees while allowing influence on the establishment of the new forest. The effects of salvage harvest would be the same as those described in Alternative 2, but would affect fewer acres. Only 1,549 acres would be treated through salvage operations under this alternative. Effects in unharvested areas would be similar to conditions described under Alternative 1.

Under Alternative 3, artificial regeneration by planting Engelmann spruce is planned for approximately 170 acres. Actual planting acres would be determined through post-treatment evaluations based upon desired species composition, distribution, and stocking levels, in an effort to maintain landscape diversity in composition, structure, and function. Desired stocking levels would likely be higher than, but would not be less than, Forest Plan restocking standards. The effects of *armillaria* root disease would be the same as those described under Alternative 2, but over a smaller area.

Both hazard tree removal and fuels reduction treatments would be the same as described in Alternative 2.

Cumulative Effects

The cumulative effects analysis for forest health includes all of the spruce/fir forest stands on public and private lands within and adjacent to the analysis area. The analysis considers spruce beetle infestations that have been observed in this area during the last seven years and the potential for continued outbreaks over the next 5 years. The probability for ongoing spruce beetle outbreaks is high over the next 5 years due to the current weather patterns, spruce beetle populations in the area, and stand conditions. The spruce/fir forests across the Rio Grande are currently undergoing a large amount of spruce beetle activity where thousands of acres are being affected.

The Cumbres project analysis area is bounded on the north by Backcountry Area (MAP 3.3), on the east by Scenic Byways (MAP 4.21), and on the west and east by private property. On the west is also the Rio de los Pinos project area, which is adjacent to the South San Juan Wilderness Area and Backcountry Areas. Significant spruce beetle mortality has been observed in all areas to the west excluding some private, which was cut heavily within the past 20 years. Backcountry and wilderness areas would remain untreated and natural processes would continue in these areas without human intervention, while some degree of salvage activity could be expected on private land.

Nearby efforts to treat spruce beetle activity include the County Line Vegetation Management Project, the Rio de los Pinos Vegetation Management Project, and the Trujillo Meadows Campground Vegetation Management Project. All of these projects would contribute toward removing some spruce beetle from the forest, but it is probable that the sum total of these efforts would have little impact on bark beetle populations. These sales may temper beetle-caused mortality on a localized (stand) level and allow some portions of the older age class spruce to survive the current wave of mortality.

The action alternatives are, however, expected to improve forest conditions in the future by increasing heterogeneity within a landscape that is experiencing a broad scale disturbance event. This influence would affect stand structure, species composition mix, and CWD distribution and loading within the treated areas. As a result, improved resiliency to insect and plant pathogens and changes in climate pattern is expected. None of the alternatives are expected to result in significant impacts to the presence and persistence of forest vegetation across the landscape.

3.3 Forest Management

Scope of Analysis

The forest management analysis focuses on the proposed management activities within the Analysis Area to address the spruce beetle infestation and timber productivity. Forest management refers to the harvesting practices and other silvicultural treatments intended to manipulate forest vegetation for specific management objectives as well as the associate goal of a sustained yield of forest products. See the Forest Health section for a review of vegetation types and extent of the analysis area.

Existing Conditions

The majority of the analysis area has been harvested and/or had other silvicultural treatments in the past. The listing of past timber management and other activities that have occurred in the analysis area that influenced the existing condition are located in Appendix C, tables C-1 and C-2.

Shelterwood preparatory cuts (light partial cuts) make up the largest portion of the previous timber harvest activity that occurred in the analysis area. These treatments opened up the stands (removing about 1/3 of the basal area) to allow the present abundant natural regeneration of spruce and fir to become established. Shelterwood establishment cuts removed approximately 50 percent of the original basal area to promote regeneration establishment. Shelterwood removal cuts and overstory removal cuts released the advanced regeneration from overstory competition and increased sapling growth and vigor.

Abundant regeneration has also developed in most of these stands, including the patch and stand clearcuts. Even with all the previous harvest and recent salvage operation to remove infested trees within the analysis area, the high population of spruce beetle has infested almost all spruce greater than 8 inches in diameter in most stands. Table 3-1 shows the estimated increase in the percent of overstory spruce in the different units infested by spruce beetle between 2011 and 2013 field surveys. The bark beetles have affected the majority of overstory spruce in all units and surrounding stands.

Past conifer clearcuts have been successfully regenerated to dense spruce and fir saplings and pole size trees. As a result, these stands are fairly resistant to spruce beetle infestation and will most likely remain as green islands within the project area.

The analysis area contains some of the most productive timber growing sites found on the Rio Grande National Forest. The current structure of the majority of stands within the analysis area is primarily mature spruce/fir, although some are in the stand initiation structural stage. The average age of the dominate trees within the spruce/fir stands varies between 150 to 200 years. The stands may be characterized as sparse to dense, mature to over-mature Engelmann spruce/subalpine fir timber stands, with a range of basal areas generally between 100 and 200 square feet per acre. A minor component of aspen is present within some stands near the eastern edge of the analysis area. The stand age and high percentage of spruce in the overstory made these stands susceptible to spruce beetle attack under drought conditions. Openings created by past timber harvest have regenerated to a mix of spruce and subalpine fir saplings, but predominantly fir. See table 3-1 for stand composition by species.

Table 3-1. Stand conditions by proposed harvest unit number.

Harvest Unit	Acres	Current Regeneration (tree/acre)	Overstory Composition by Species, ≥ 8" dbh	% Mortality of Spruce ≥ 8" dbh		Estimated Planting Acres
				2011	2013	
1	122.3	333	ES-81%, TF-19%	90%	95%	122
2	142.9	565	ES-68%, TF-32%	65%	95%	143
3	94.3	565	ES-68%, TF-32%	65%	95%	94.3
4	193.7	925	ES-62%, TF-38%	80%	95%	0
5	105	925	ES-62%, TF-38%	95%	95%	0
6	165.8	240	ES-58%, TF-42%	70%	95%	166
7	154.1	925	ES-62%, TF-38%	90%	95%	0
8	197.2	925	ES-62%, TF-38%	80%	95%	0
9	40.5	861	ES-92%, TF-8%	80%	95%	0
10	13.2	925	ES-62%, TF-38%	75%	95%	0
11	149.2	1043	ES-92%, TF-8%	75%	95%	0
12	183.7	981	ES-75%, TF-25%	70%	95%	0
13	135.8	1314	ES-62%, TF-38%	65%	95%	0
14	140	1067	ES-100%	30%	95%	0
15	147.4	1113	ES-70%, TF-30%	75%	95%	0
16	124.3	565	ES-68%, TF-32%	65%	95%	124
17	95.7	700	ES-94%, TF-6%	30%	95%	0
18	67.6	1850	ES-100%	70%	95%	0
19	70.2	700	ES-73%, TF-27%	40%	95%	0
20	39.3	925	ES-62%, TF-38%	70%	95%	0
21	74.7	925	ES-62%, TF-38%	80%	95%	0
22	41.2	925	ES-62%, TF-38%	80%	95%	0

Old Growth

None of the forested stands proposed for treatment meet the criteria for old growth as defined by Mehl (1992). Presently, the spruce stands do not meet the minimum age, size, and live tree density requirements to be old growth due to the extensive spruce beetle mortality.

Direct and Indirect Effects

Alternative 1 – No Action

Under this alternative, no salvage of beetle infested or killed timber would occur. Public firewood gathering would still occur on approximately 469 acres. The economic value of spruce beetle-killed/infested trees would not be realized and some Forest Objectives listed in chapter 1 would not be met.

With the loss of the Engelmann spruce seed source due to beetle kill, it can be expected that many residual stands would be dominated by subalpine fir. Some openings (gaps) would be created when dead trees fall, although individual gaps in the canopy would generally be rare, due to the widespread loss of canopy closure. An opening in a forest canopy is associated with the death, blow-down, or other removal of all or a significant portion of the overstory trees. These gaps are often characterized by high structural and species

diversity due to the growth of understory flora and colonization of new species, which are facilitated by the microclimatic conditions of the gap (Dunstar 1996). Overall, loss of canopy closure would reduce the opportunities for protected microclimatic conditions that provide gap dynamics.

Aspen, where present, may regenerate in openings created by the mortality of spruce, as permitted by ungulate browse pressure. In stands where timber production is the objective, stands dominated by subalpine fir rather than Engelmann spruce are less desirable for the following reasons: a) fir has a shorter life span than spruce, b) fir is more susceptible to more insect and disease attacks than spruce, c) the structural characteristics of the wood fiber are inferior to spruce, and d) it has less economic value than spruce. Forest Plan desired conditions for MAP 5.11 and 5.13 would not be addressed under this alternative.

By not salvaging the dead spruce, approximately 20 to 30 MMBF of National Forest timber would not be utilized for wood products or contribute to sustained yield of forest products. The public would most likely obtain an equivalent amount of wood products from other sources, including private land or other countries.

Fuels reduction treatments would not occur within WUI areas up to 400 feet from adjacent private land or other infrastructure. Fuels treatment areas along roads and private boundaries would retain dense understory vegetation and fuel loadings, except where influenced by public firewood gathering.

Hazard tree removal may not occur up to 2.0 tree heights of open roads, fences, private land, cabins or other infrastructure such as campgrounds or developed sites unless authorized by another decision. Some of these hazards trees would be mitigated through public firewood gathering.

Alternative 2 – Proposed Action

This alternative provides the opportunity to salvage dead and dying Engelmann spruce, perform fuel reduction treatments within WUI areas, and remove hazard trees around infrastructure. Harvest would be accomplished with ground-based (tractor) logging methods through a variety of large and/or small sales, including public/commercial firewood-gathering areas.

The intent of the salvage is to place timber on the market for the American public in time to capture the value of the beetle-killed spruce trees, before the effects of wood decay eliminates that value. The object of the silvicultural prescription would be to harvest spruce trees 8 inches Diameter at Breast Height (dbh) and larger within the salvage units, which were recently killed by, or are currently infested with, spruce beetle. Conifer removal from selected aspen clones may also increase the vigor and persistence of these on the landscape. In spruce/fir stands, a minimum of 4 snags per acre would be retained for wildlife habitat, as well as fir and uninfested spruce. Exceptions to this are those trees that must be removed from skid trails, landings, or for safety reasons. The removal of hazard trees would include live trees prone to windthrow which could cause harm or damage infrastructure.

The minimum number of spruce/fir snags, live subalpine fir, and live uninfected spruce to be left is specified in the Project Design Criteria (PDC), chapter 2. Treated stands are expected to have a below-average susceptibility of windfall risk; having been previously managed, these trees have been exposed to lower stocking densities and have developed wind firmness over time. However, some windthrow is expected to result from this treatment due to the extensive nature of the mortality and resulting salvage. Trees most susceptible to windthrow would be residual live overstory fir, which have greater wind resistance than snags. A loss of these trees to windfall would not affect management objectives or future management activities within the analysis area.

Following removal of the dead or dying spruce, the Forest Service would plant Engelmann spruce seedlings on those areas where post-sale reforestation surveys indicate that species composition, distribution, and/or

stocking is below desired levels. The desired species mix and stocking levels will be determined on a stand-by-stand basis, but will be not less than the minimum Forest Plan standard of 150 trees per acre. Although stand averages are good across most units, not every acre is uniformly stocked; some areas are high, some areas are low. Harvest activities are generally not expected to create under-stocked areas. The logging process itself would provide the necessary soil scarification, allowing available seed to reach mineral soil, and helping prepare the sites for planting. Light logging slash left in the woods would be used to benefit young seedlings by protecting them from excessive sunlight, extremes of temperature, desiccation, and grazing animals (Smith et al. 1997). It is anticipated that about 650 acres could require planting based existing stand data. Actual planting acres will be determined through regenerations surveys following management activities. Forest Plan desired conditions for MAP 5.11 and 5.13 would be addressed under this alternative.

Openings (gaps) would be created in the units more rapidly than Alternative 1, although individual gaps in the canopy would generally be rare, due to the widespread loss of canopy closure. Overall stand structure would be open for the next 30 years (see additional discussion in the Forest Health section).

In this alternative, approximately 20 to 30 MMBF would be harvested from up to 2,498 acres. Between all alternatives, this alternative would contribute the most to long term sustained yield of forest products. The estimation of timber volume that would be removed is derived from three sources: 1) stand exam and pre-cruise data taken in 2011, 2) this stand exam data projected to 2012 by the Forest Vegetation Simulation (FVS), Central Rockies Variant, and 3) field surveys in 2010-2011, which estimated the percent of infested spruce trees. All of these sources are subject to some error. There is also the uncertainty whether or not the beetles will attack 100 percent of the mature spruce trees within these stands. Therefore, these volumes must be considered a best estimate and subject to change. More precise data would come when the timber is actually cruised during the sale preparation process.

Also within this alternative, about 171 acres of fuels reduction treatments is planned within WUI areas up to 400 feet from adjacent private land. Treatments would reduce surface, ladder, and canopy fuels (i.e. fuel loading) to decrease the potential for severe wildfire and the likelihood of wildfire spreading between National Forest and private lands. Ladder and canopy fuels (shrubs as well as seedling, sapling, and pole sized trees) would be thinned by hand-felling techniques and pile burning or, where practical, machinery equipped with cutting or grinding heads. The effects of this action on existing vegetation would decrease tree density and improve tree vigor of the remaining trees, making them more resistant to insects and disease.

Hazard tree removal would be implemented within a distance of up to 2.0 tree heights from open roads, fences, private land, cabins, or other infrastructure. Hazard distance would depend on localized factors such as slope, topography, and/or the number and arrangement of potentially hazardous trees. Where feasible, these trees would be cut and removed as part of timber harvest activities or removed as firewood by adjacent landowners; otherwise they would be felled, bucked, and left in place, unless otherwise specified. Both fuels treatment and hazard trees could consist of cutting vegetation with chainsaws and handpiling slash or grinding it with mechanized equipment. Any slash piles created would be burned during favorable weather conditions.

The designated firewood gathering areas (97 acres) are intended to meet specific product needs, but are expected to have greater overall resource impacts. These impacts will result from increased access needs and uncontrolled felling operations, but would be no greater than impacts from firewood gathering under Alternative 1.

The PDC for timber/silviculture (chapter 2) are routinely implemented in timber sales on the Forest. The design criteria are feasible because they can be incorporated into existing timber sale contract provisions.

The design criteria have proven to be an effective means of assuring regeneration and providing for resource protection.

Alternative 3 – Limited Action

As with Alternative 2, this alternative provides the opportunity to salvage dead and dying Engelmann Spruce (up to 1,549 acres) along with fuel reduction treatment within WUI areas (171 acres) and removing of hazard trees around infrastructure.

This alternative would produce an estimated volume of 15 to 20 MMBF. Reforestation through artificial regeneration may occur on approximately 170 acres of non-stocked or under-stocked areas. Actual planting acres would be determined through regenerations surveys following management activities. Harvesting would be accomplished with ground-based (tractor) logging methods through a variety of large and/or small sales, including public/commercial firewood-gathering areas.

The difference between Alternative 3 and Alternative 2 is that Alternative 3 would propose salvage on about 949 fewer acres and regenerate approximately 480 fewer acres through harvest activities, thereby addressing the project purpose to a lesser degree.

Although fewer acres are being treated within this alternative, the effects of salvage harvest for the removal of trees killed or infested by spruce beetle have already been described under Alternative 2. The reduction in designated public firewood gathering areas would not limit the public, as firewood gathering would still be permitted along roads in areas not under a timber sale contract.

The effects of fuels reduction treatment and hazard tree removal are the same as described in Alternative 2.

Cumulative Effects

When evaluating the effects of management activities, two aspects must be considered: the effect of salvage on current forest management goals, as well as the potential impact upon future forest goals. Both action alternatives would contribute toward providing a sustainable supply of forest product to timber industry in the present, as well as into the future. When added to other past, present and future sales, the proposed harvest activities would help meet, but not exceed, annual Forest Plan Allowable Sale Quantity for softwoods. These actions, therefore, would remain within the FEIS analysis for the Forest Plan.

Since most of the roads needed to harvest the timber are already in place, new road construction would not be a major factor affecting forest management decisions and alternative viability. Prompt removal of the dead trees, followed by replanting new trees where needed, would accelerate the process towards getting these units back to the desired condition.

Alternative 1, on the other hand, would address the disparity between existing conditions and management objectives only to the extent to which public firewood gathering would occur. A majority of the existing commercial resources would be lost as a result of mortality and deterioration. Likewise, future commercial resources are expected to be lost, as future stand composition would promote less-desirable species which are more susceptible to insect and disease influences. These conditions could extend into the next 125 to 175 years.

With the exception of minor amounts of blow-down salvage, no future timber harvests are anticipated in the in the immediate future. Additional harvesting and hazard tree removal may occur on private land to protect private land resources and infrastructures, but the extent is unknown and would not impact forest management decisions on federal lands. Table 3-2 presents a summary of the acres of treatment for present and future timber harvest within the analysis area.

Table 3-2. Present and future timber harvest activity.

Timber Sale	Acres	Year	Harvest Objective
Present	2,498	2014-2019	Salvage

Past management activities have created age, structural, and species diversity throughout the analysis area (Appendix C – tables C-1 and C-2). The proposed actions are expected to continue to promote these attributes across the landscape.

3.4 Wildlife

Scope of Analysis

The scope of this analysis discusses Threatened, Endangered, Proposed, and Region 2 designated Sensitive terrestrial wildlife. Aquatic species are addressed in the Fisheries section. The analysis was conducted for various species at the appropriate scale as follows:

- Canada lynx – the analysis area is the Rito Archuleta Lynx Analysis Unit (LAU).
- All other terrestrial TES species are analyzed within the Cumbres Vegetation Management analysis area boundary.
- Management Indicator Species (MIS) are analyzed at the Forest Level
- Migratory Birds - Potential influences on migratory birds were tiered to conservation objectives at the Forest-wide scale and the Southern Rockies Colorado Plateau Bird Conservation Region (BCR) 16 (additional information on BCR 16 is available online at: http://www.nabcius.org/bcrs.htmo).

This section summarizes a more detailed analysis contained in the wildlife Biological Assessment (BA) and Biological Evaluation (BE), and wildlife specialist report which is located in the project record.

Existing Conditions

The existing condition of the Cumbres Analysis Area has been impacted by historic activities; including timber, grazing, and recreation, in addition to the extensive spruce infestation and mortality in the Cumbres, Trujillo Meadow, and Neff Mountain areas. Beetle infestations are also occurred in the South San Juan Wilderness area (figure 2-1).

Wildlife species that have habitat and occur or may occur within the Cumbres Vegetation Management analysis area involve those species that are most commonly associated with the spruce-fir cover type. Riparian vegetation also occurs within or adjacent to the analysis area in association with stream and river channels and small ponds and wetlands. A representative sample of these species groups is as follows:

- *Reptile and Amphibian Species:* Reptile species are relatively scarce in the spruce-fir cover types of Colorado, with the western terrestrial garter snake being the only common species. This garter snake has semi-aquatic life history needs and could be expected to respond to habitat changes in a manner similar to amphibians. The tiger salamander is likely to be found within the analysis area.
- *Avian Species:* There are at least 17 species of birds that are primarily associated with spruce-fir forests in the Southern Rocky Mountains of Colorado (Beidleman 2000). An additional 11 species are common in mixed-conifer forests, many of which also occur in the spruce-fir system on the Rio Grande National Forest. Avian species of management interest include the: Olive-sided flycatcher

(R2 Sensitive and Colorado Bird Conservation Plan {BCP} Priority Species), boreal owl (R2 Sensitive and Colorado BCP Priority Species), hermit thrush (management indicator species (MIS)), brown creeper (MIS) and the Hammond's flycatcher (Colorado BCP Priority Species). Other spruce-fir associated species that occur or may occur in the Analysis Area include the mountain chickadee, red-breasted nuthatch, pine grosbeak, pine siskin, and ruby-crowned and golden-crowned kinglets.

- *Mammal Species:* Some mammals that occur or may occur in the Cumbres Vegetation Management Analysis Area include Rocky Mountain elk (MIS), mule deer (MIS), Canada lynx (Federally Threatened), American marten (R2 Sensitive), black bear, short-tailed and long-tailed weasels, southern red-backed vole, least chipmunk, red squirrel, snowshoe hare, porcupine, heather vole, hoary bat, and little-brown bat.

Overall, the spruce beetle epidemic, and previous timber operations including all associated activities (i.e. logging roads, skid trails, landings and tree harvesting) have been the pre-dominant factors that have influenced the current existing condition and wildlife habitat throughout the analysis area. To a lesser extent, recreational activities and cattle grazing have had an impact on the area, but more so at the species disturbance level and not the physical landscape. It's anticipated that all of the activities within analysis area have had some level of impact on wildlife and their biological requirements.

Federally Listed Species

Table 3-3 includes a description of general habitat for listed species along with the summary of the findings for Threatened, Endangered, or Proposed Wildlife Species.

The Biological Assessment prepared for Threatened and Endangered (T&E) species considered four species and determined that suitable habitat exists for only one, the Canada lynx. Canada lynx is further analyzed in each alternative for the Cumbres Vegetation Management Project. Mexican Spotted Owl, Southwestern Willow Flycatcher, and Uncompaghre Fritillary Butterfly were not further analyzed due to lack of suitable habitat within the analysis area. *For this project, there will be No effect to the Mexican Spotted Owl, Southwestern Willow Flycatcher, or Uncompaghre Fritillary Butterfly or their habitat.*

Table 3-3. Summary of findings for threatened, endangered, or proposed species.

Species	General Habitat	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3 Limited Action
Canada lynx *Felix lynx canadensis*	Mixed conifer forests and aspen/willow/shrub-steppe.	NE	LAA	LAA
Mexican spotted owl *Strix Occidentalis lucida*	Steep canyons with a Douglas-fir, white fir, Ponderosa pine/ pinyon- juniper component	NE	NE	NE
Southwestern willow flycatcher *Emidonax trailii extimus*	Riparian habitats along rivers, streams or other wetlands, where dense growths of willows or other shrub and medium-sized trees are present	NE	NE	NE
Uncompahgre Fritillary butterfly *Boloria acrocnema*	Alpine habitat above 11,000 feet with a snow willow component	NE	NE	NE
North American Wolverine (P) *Gulo gulo luscus*	Primarily associated with remote subalpine and alpine habitats, utilizes large rock talus areas for denning; may utilize spruce-fir forests. Marmots and carrion possible key food resources. Utilizes a wide range of upper montane habitat types due to mobility and large home range.	NE	No Jeopardy	No Jeopardy

NE – No Effect; **NLAA** = Not likely to adversely affect.

Direct and Indirect Effects

Canada Lynx

The Cumbres Vegetation Management Area occurs within the Rito Archuleta Lynx Analysis Unit (LAU). This LAU encompasses approximately 87,002 acres in size. Effects on the Canada lynx were assessed by comparing the LAU baseline conditions to changes predicted from the alternatives, in addition to analyzing how the project meets the Objectives, Standards, and Guidelines in the Southern Rockies Lynx Amendment (2008).

The Cumbres Vegetation Management Area occurs within the Rito Archuleta Lynx Analysis Unit (LAU). This LAU encompasses approximately 87,002 acres in size. Figure 3-4 shows the LAU boundary in relation to the Cumbres project area.

Effects on the Canada lynx were assessed by comparing the LAU baseline conditions to changes predicted from the alternatives, in addition to analyzing how the project meets the Objectives, Standards, and Guidelines in the Southern Rockies Lynx Amendment to the Forest Plan (2008).

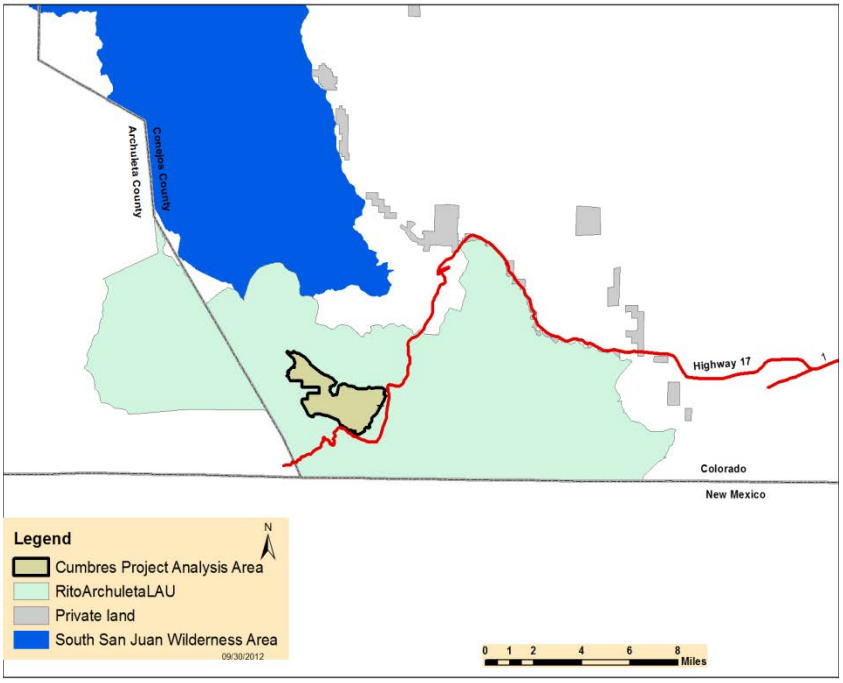

Figure 3-4. Rito Archuleta LAU in relation to Cumbres project area.

The purpose and need for the amendment was to establish management direction that conserves and promotes the recovery of lynx, and reduces or eliminates potential adverse effects from land management activities and practices on national forests in the Southern Rockies, while preserving the overall multiple-use direction in existing plans. ***Objectives and Standards in the SRLA pertaining to the Cumbres Project include:***

- **Objective VEG O1:** Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx.
- **Objective VEG O2:** Provide a mosaic of habitat conditions through time that support dense horizontal cover, and high densities of snowshoe hare. Provide winter snowshoe hare habitat in both the stand initiation structural stage and in mature, multi-story conifer vegetation.
- **Objective VEG O4:** Focus vegetation management in areas that have potential to improve winter snowshoe hare habitat but presently have poorly developed understories that lack dense horizontal cover.
- **Standard VEG S1:** If more than 30 percent of the lynx habitat in an LAU is currently in a stand initiation structural stage that does not yet provide winter snowshoe hare habitat, no additional habitat may be regenerated by vegetation management projects.
- **Standard VEG S2:** Timber management projects shall not regenerate more than 15% of lynx habitat on NFS lands within an LAU in a ten-year period (salvage harvest within stands killed by beetles does not add to the 15 percent, unless the harvest treatment changes the habitat to unsuitable).

- **Standard VEG S6:** Vegetation management projects that reduce winter snowshoe hare habitats in multi-story mature or late successional conifer forests may occur only/Exception 3 applies – For incidental removal during salvage (e.g. removal due to location of skid trails)

Alternative 1 – No Action

Under this alternative, there is no potential for direct or indirect effects from project activities as no project will occur. Existing canopy cover will still continue to degrade as a result of the spruce beetle infestation. However in all units, existing and future canopy cover is estimated to continue supporting primary suitable habitat for lynx. High quality dense horizontal cover (DHC) and lesser quality horizontal cover will continue to provide winter snowshoe hare habitat, as well as summer foraging habitat. Through time, the forest will provide a patchy distribution of deadfall, standing dead and newly regenerating trees and shrubs across the landscape.

Forest regeneration is expected to improve as the overhead canopy is opened up in random areas and release occurs. Subalpine fir may predominate in future stands but will still provide valuable habitat to lynx in addition to aspen and spruce. Coarse woody debris (CWD) will accumulate on the forest floor in large amounts in some areas. This in combination with new regeneration of various species, will provide visual obscurity, cover, foraging habitat and security for movement, and may provide opportunities for future denning. Lynx will not be disturbed and/or displaced from any road construction; WUI fuels reduction or hazard tree removals. This alternative may decrease hiker, ATV or snowmobile activity, because of CWD accumulation. Thus it should also decrease the potential for more snow compaction or predatory advantage.

If a large high intensity wildfire would occur, the impacts to lynx habitat would be immediately detrimental. As discussed in the Fire and Fuels section, large wildfires in the spruce/fir vegetation type are infrequent except under extreme weather conditions. If a large wildfire were to occur, all understory vegetation, CWD, mature trees and multistoried attributes if present, would be temporary lost which could have major adverse effects on lynx habitat. However, because this is only speculative in consideration, a determination will not be presented.

Overall, under a non-wildfire scenario, this alternative would allow natural disturbances such as spruce beetles to slowly re-shape the forest; providing the best opportunity for a continued and naturally created mosaic pattern across the landscape that would continue to provide suitable habitat for lynx as natural processes continue.

DETERMINATION FOR ALTERNATIVE 1 "No Action" (No Project Activity): For this alternative, there will be No Effect on Canada Lynx, as no project activities will occur.

Alternative 2 – Proposed Action

Effects of salvage harvest in lynx quality habitat: If present, lynx are expected to be disturbed and displaced from salvage activities. Disturbance and/or displacement is not expected immediately throughout the entire analysis area, as harvest activities would occur overtime (over 5 plus years), as each individual sale initiates and progresses. Overtime, lynx should move out of the area of disturbance into more suitable adjacent habitat. However, because of the extensive beetle infestations within the area and surrounding forest, quality lynx habitat is expected to be more difficult to find. Lynx may move back into post-harvested areas that still contain good amounts of DHC (i.e. winter snowshoe hare habitat) that supports habitat suitability, but this depends upon the level of other/new disturbances present as a consequence of harvest created openings (i.e. new snowmobile use).

Most salvaging activity is expected to occur later in the summer (late June/early July) as lingering snow accumulations melt and allow access into the area. If a denning lynx was present, she and her kittens should

have already left the area to another location. However, if salvage activities could resume earlier (snow conditions warranting) during the May/June kitten birth time period, denning disturbance would be expected to occur. Parent lynx may then abruptly move kittens in order to avoid such disturbance. Progressively, it's expected that lynx would remove themselves from disturbance and not occupy, or greatly limit their presence within the analysis area.

Lynx preferentially forage in spruce-fir forest with high horizontal cover, abundant hares, deep snow and large diameter trees during the winter (Squires et.al. 2006). Indirect effects of timber salvage are expected to reduce the amount of mature overstory trees and DHC horizontal cover habitat, down woody-debris (CWD) and consequently reduce the stands capacity to remain suitable and support snowshoe hares. Mature tree canopy cover is being reduced currently by the beetle epidemic however; these units are still maintaining their suitability of lynx habitat. Post-salvage canopy conditions are not expected to support lynx habitat suitability in most units as they will be returned to the Stand Initiation Structural Stage (SISS), except where DHC can maintain suitability. These effects are expected to occur over time as salvaging completes within each sale area. Indirect effects within each completed salvage unit could last up to 30 years depending on pre/post-harvest site conditions.

Mature late successional stands with closed canopy conditions are not expected for over 100 years. Although, within some of the harvest units, lynx habitat is would be expected to remain in a suitable condition overall, if there are mature multi-storied trees and/or DHC present to support snowshoe hares. In the long-term (30-50 years post-harvest), improvements in understory composition and regeneration, stem densities, forest maturity and canopy cover, and overall forest diversity should have occurred along with a stand capacity that can support habitat suitability, lynx and its prey base.

Effects of salvage harvest on prey-base resources: Lynx are expected to see a reduction in the amount of prey that's available with the area from the reduction in the stands capacity to support snowshoe hares, because of the removal of mature trees and DHC. Concurrently, the effects from harvesting and the spruce beetle infestation are expected to cause a reduction in red squirrel densities. Overall, these changes in prey abundance (primary and secondary) are be expected to result in very low to no lynx reproduction that could cause lynx to abandon their home range and look for prey resources elsewhere. For snowshoe hare and consequently lynx, these effects would be up to 30 years or until understory conditions provide visual obscurity, forage and overall *quality winter snowshoe hare habitat* (generally 30-50 years), depending on site conditions. Improvements in red squirrel densities are also not expected for up to 40 years, or until trees reach the reproductive capacity to bear cones. The remaining suitable habitat that is not impacted from timber harvest (as noted in above paragraph) could be expected to support hare populations at a smaller capacity that may allow lynx to incidentally foraging in some harvest units.

Effects of salvage harvest on lower quality horizontal cover (not DHC): Incidental damage from salvage harvesting in mature stands where DHC is not pre-dominant can still result in the reduction of snowshoe hare habitat. However, these reductions would occur in lesser quality foraging (i.e. summer forage) habitat that likely contains a lower density of snowshoe hares. Damage and reductions in this type of habitat can have effects on lynx because it will also reduce the timber stands capacity to support snowshoe hares. For these alternatives; units that do not contain winter snowshoe hare habitat, (i.e. dense horizontal cover, 1 to 2 meters above average snow levels) are also documented as having some horizontal cover that is fully capable of supporting hares at a lower density, and providing forage opportunities for lynx. The effects to these units would be identical to effects of quality DHC habitat and also estimated at approximately 30 percent of the unit's acreage. Overall, the reduction of horizontal cover by incidental impacts of the developing understory can impede the future development of these stands into quality winter snowshoe hare habitat and overall a mature multi-storied stand. This can also prevent or delay habitat suitability, and future occupancy of lynx and associated prey.

For all horizontal cover (DHC and summer), the 30 percent incidental calculation is only a current estimation used for monitoring purposes. Actual incidental removal would be calculated in post-harvest monitoring and is expected to actually range from 15 to 60 percent incidental removal. This will provide a baseline percentage for future harvesting in lynx habitat.

Effects of salvage harvest on habitat connectivity: Objective ALL01 of the SRLA is to maintain or restore lynx habitat connectivity in and between LAUs and in linkage areas.

Following the Project Planning Standards identified in the Southern Rockies Lynx Amendment (SRLA), this analysis addresses connectivity and proposes to maintain habitat linkages through "no entry" Water Influence Zones (WIZs) distributed throughout the analysis area. These riparian buffers would be 200 feet wide, 100 feet on either side of intermittent or perennial stream channels. In addition, all live spruce trees (trees not dying from infestation); all subalpine fir and aspen would not be harvested except where safety and operational conditions warrant. These could provide sufficient cover and security for movement across the area. In addition, remaining DHC greater than 35 percent and lower quality summer foraging habitat should not only provide snowshoe hare habitat, but could also provide some level of cover and habitat connectivity.

Effects from roads on lynx and prey-bases: Road construction/maintenance is expected to add to species disturbance and displacement, and increase the potential for more reductions in prey species. Approximately, 1 acre of new road construction has been accounted for in the temporary loss of suitable habitat. In addition, road construction would likely increase the presence of humans if access is available. However, lynx may have already been disturbed by the initial road construction activities and therefore may have already left the area. Constructed and re-constructed roads, even if closed post-project may result in access routes for hikers and snowmobilers, and even all-terrain vehicles (permitted or non-permitted use).

Snowmobile use may have the most influential effect on lynx and their habitat during and post-harvest, because of road construction and fewer trees overall. Repeated snowmobile traffic does result in compaction and may improve the ability of competitive predators such as the coyote to access lynx habitat. In addition, road construction will increase the access of snowmobilers into post salvage units, which are expected to provide more play areas. An increase in snowmobile traffic and compaction in the area would increase the potential for lynx disturbance and potentially hinder regeneration efforts. Overall, no permanent roads will be added to the area. Post sale, all roads will be closed, except for those roads that have currently open to travel used. However, the effects from any new, re-opened or decommissioned road could linger up 30 years post-harvest, depending on human use and regeneration success.

Effects of WUI Treatment on lynx and prey bases: Wildland Urban Interface treatments (figure 2-2) will focus on thinning of understory trees and shrubs, as needed, to modify potential fire behavior. Only 71 acres of this treatment would be in lynx habitat. The intent of this treatment is primarily to benefit private land owners in the immediate and long term by creating defensible space and reducing the potential for wildfire spread. Treatments are expected to consist primarily of cutting vegetation with chainsaws and hand piling slash, or grinding it with mechanized equipment.

Understory habitat consisting of smaller diameter trees, saplings and seedlings would be specifically targeted for removal. Any slash piles created would be burned during accumulated snow conditions. In addition, salvage operations, which are an allowable tool in WUI areas, will also occur in each unit as part of the initial salvage project. The understory habitat within the WUI treatment areas is in the early stages of development, thus it does not contain any quality winter snowshoe hare habitat. However, it does provide some level of habitat for lynx that can be expected to support snowshoe hares at lower densities. Therefore effects of these treatments would be nearly identical to effects from harvest activities discussed in previous

sections, where lynx would be affected through the reduction of the quality and productivity of their habitat, and the habitat of snowshoe hares.

Overall, the impacts from WUI operations within these units are expected to impede future development of winter snowshoe hare habitat reduce the capacity of the stand to support any hares, and consequently convert 160 acres to unsuitable lynx habitat (approximately 11 acres of the proposed 171 WUI treatment areas is not considered lynx habitat).

DETERMINATION FOR ALTERNATIVE 2: implementation of this alternative; *May Affect, Likely to Adversely Affect the Canada Lynx*

Rationale for the determination:

- Timber salvage is expected to reduce the amount of mature overstory trees and dense horizontal cover habitat and consequently reduce the stands capacity to remain suitable and support snowshoe hares.
- Wildlife PDC is in place to limit the amount of disturbance to lynx and their habitat, live trees, understories and DHC however, it is not expected to reduce the overall impacts to where the effects to lynx are proven insignificant and discountable.
- Future regeneration and replanting are expected to be beneficial in long-term (30-50 years), however prior to that timeframe the capacity of these timber stands to support snowshoe hare populations would be reduced for some time.
- The average spruce mortality within the entire project area is over 70 percent and rising annually. Red squirrel population abundance is reduced when there is high spruce mortality.
- Lower population densities of the red squirrel, associated with mature spruce mortality, are a significant factor in the existing conditions of the environmental baseline, affecting lynx within the project area and surrounding Rito Archuleta LAU.
- Low snowshoe hare abundance is expected to be concurrent with low red squirrel abundance, which can result in no or low lynx reproduction, and consequently may force lynx to leave and expand their home range as necessary to look for food resources elsewhere.
- Alternative 2 would impact a total of about **1,983 total acres**[5] (79 percent) of lynx habitat within the project area, which is about 5 percent of total lynx habitat within the Rito Archuleta LAU.
- Additional reduction of snowshoe hare habitat and overall suitable lynx habitat described in the biological assessment constitutes a measureable and/or detectable effect

Alternative 3 – Limited Action

For Alternative 3 the effects to lynx would be the same as alternative 2 in harvested areas. However, since harvest is proposed on fewer acres effects would occur on a smaller footprint of lynx habitat and be at a lesser magnitude as shown in table 3-4.

DETERMINATION FOR ALTERNATIVE 3: implementation of this alternative; *May Affect, Likely to Adversely Affect the Canada Lynx*

[5] Note that total acres affected consider all lynx habitat, not just acres applying to SRLA Exemptions and Exceptions which are accounted for in table 3.4.

Rationale for determination:

- Timber salvage is expected to reduce the amount of mature overstory trees and dense horizontal cover and consequently reduce the stand's capacity to remain suitable and support snowshoe hares.
- Wildlife PDC is in place to limit the amount of disturbance to lynx and their habitat, live trees, understories and DHC however, it is not expected to reduce the overall impacts to where the effects to lynx are proven insignificant and discountable.
- Future regeneration and replanting are expected to be beneficial in the long-term (30-50 years), however prior to that timeframe the capacity of these timber stands to support snowshoe hare populations will be reduced for some time.
- The average spruce mortality within the entire project area is over 70 percent and rising annually. Red squirrel population abundance is reduced when there is high spruce mortality.
- Lower population densities of the red squirrel, associated with mature spruce mortality, are a significant factor in the existing conditions of the environmental baseline, affecting lynx within the project area and surrounding Rito Archuleta LAU.
- Low snowshoe hare abundance is expected to be concurrent with low red squirrel abundance, which can result in no or low lynx reproduction, and consequently may force lynx to leave and expand their home range as necessary to look for food resources elsewhere.
- Alternative 3 would impact a total of about **1,352 total acres**[6] (83 percent) of lynx habitat within the project area which is about **3%** of the total lynx habitat within the Rito Archuleta LAU.
- Additional reduction of snowshoe hare habitat and overall suitable lynx habitat described in the biological assessment would be expected to constitute a measureable and/or detectable effect on lynx

Table 3-4. Comparison of expected changes in SRLA baseline by alternative.

Rito Archuleta LAU Alternative Comparison	Existing Baseline	Alternative 2	Alternative 3
Description	**Acres (%)**	**Acres (%)**	**Acres (%)**
Total Acres	87,002 (100%)	87,002 (100%)	87,002 (100%)
Total Acres of Lynx Habitat	41,676 (48%)	41,676 (48%)	41,676 (48%)
Acres of Suitable Habitat	41,658 (99%)	40,367 (1,291 ac. impacted includes 160 ac WUI & 1 ac. new road)	40,716 (942 ac. impacted includes 160 ac WUI & 1 ac. new road)
Acres of Unsuitable Habitat / Stand Initiation Structural Stage (SISS).	SISS = 18 ac. (0.043%)	SISS = 1,309 ac. (3.0%) 1,291 ac. Impacted;	SISS = 960 ac. (2.0%) 942 ac. Impacted;
Meets VEG S1 – No more than 30% of the lynx habitat in an LAU currently in SISS	Yes – 0.043%	Yes – 3.0%	Yes – 2.0%
Meets VEG S2 – Timber mgmt. projects shall not regenerate more than 15% of lynx habitat in a ten-year period.	Yes	Yes	Yes

[6] Note that total acres affected consider all lynx habitat, not just acres applying to SRLA Exemptions and Exceptions which are accounted for in table 3.4.

Table 3-4. Comparison of expected changes in SRLA baseline by alternative.

Rito Archuleta LAU Alternative Comparison	Existing Baseline	Alternative 2	Alternative 3
Dense Horizontal Cover; Acres of treatments under Exceptions 1-3 in VEG S5 and Exceptions 1-3 in VEG S6 (0.5%). Forest-Wide current cap of 3,135 (Black Mesa project - 2013).	3,135 acre cap	3,036 acre new cap (99 acres impacted)	3,092 acre new cap (43 acres impacted)
Conifer removal in aspen: Acres of treatment under exception 5 in VEG S5 (1% of lynx habitat/LAU). Forest-wide cap of 10,354 ac.	417 acre cap for LAU	397 acre new LAU cap 10,334 new Forest-wide cap (20 acres impacted)	397 acre new LAU cap 10,334 new Forest-wide cap (20 acres impacted)
Wildland Urban Interface; Acres of treatment within WUIs under exemptions to VEG S1, S2, S5 or S6 (3.0%). Forest-wide cap of 25,360 ac. (Black Mesa).	26,360 acre cap	26,200 acre new cap (160 acres impacted)	26,200 acre new cap (160 acres impacted)
Acres total treatment under Exemptions & Exceptions to VEG S1, S2, S5, or S6 (4.5%) of 39,108 ac (Black Mesa project)	39,108 acre cap	38,849 acre new cap (259 acres impacted)[A]	38,885 acre new cap (223 acres impacted)

[A] *Value reflects acres of DHC impacted, acres of conifer removal in aspen, and acres of WUI treatment affecting lynx habitat.*

Effects summary for action alternatives: This project is expected to have effects to some degree on lynx considering all project design criteria in place. However, alternative 3 would be expected to impact lynx at a lesser magnitude. Direct effects to lynx could include disturbance and/or displacement from the project area, if using or present. Currently, this analysis area does contain a density of snowshoe hares however; project activities are expected to reduce the timber stands capacity to support these hares and thus reduce their densities to some level. In addition, considering the current spruce beetle outbreak, and the rate of which tree mortality is occurring, it would also be expected that the red squirrels (lynx most important secondary prey-base) abundance has been and will continue to be negatively impacted by the beetle epidemic. The implementation of this project would only add to the current impacts upon local red squirrel populations. However, as said above alternative 3 overall effects would add to a lesser degree.

Future conditions of the project area are primarily dependent on each unit's ability to regenerate and/or maintain their residual habitat after harvest. However, future beetle outbreaks could be a limiting factor in this development. Considering healthy regeneration efforts; forest growth and habitat suitability for lynx and its prey-bases should improve in the long-term (30 to 50 years), and untouched suitable habitat should still remain within the nearby South San Juan Wilderness. However, that will be relatively dependent upon the level of spruce beetle infestation on the Rio Grande National Forest.

The Standards and Guidelines of the Southern Rockies Lynx Amendment (SRLA) 2008 would still be met with the implementation of this project. However, considering the effects from the existing conditions that include the beetle infestation within the analysis area, past harvests and recreational activities—the inclusion and effects of the Cumbres Vegetation Management Project are expected to be additive. These effects would not be insignificant and/or discountable from alternative 2 and therefore, would be expected to have a measurable effect upon the Canada lynx and its habitat. However for alternative 3 the effects from this project would be questionable as to whether they would have a measureable effect on lynx. That determination would be dependent on whether the effects from alternative 3 could be proven to be insignificant and discountable -- this may not be possible to conclude. Thus this analysis will err on the side of the species for alternative 3.

Cumulative Effects

The cumulative effects analysis for the Cumbres Project is based on future State and private land, tribal or non-Federal activities that are reasonably certain to occur within the Rito Archuleta LAU. Federal actions are not addressed under Endangered Species Act (ESA) requirements. The US Fish and Wildlife Service addresses federal actions separately through their own Section 7 Consultation.

Private lands encompass approximately 6,000 acres and State Lands of 640 acres within the Rito Archuleta LAU. Known current and future activities within these two ownerships are annual grazing. Effects from grazing upon lynx and their habitat are mostly associated with minor disturbance and forage competitions between cattle and snowshoe hare. Disturbance of lynx may occur from cattle but more likely from riders. This disturbance is expected to be very minor and quite possibly non-existent because of the infrequent presence and low number of riders (1-2). Snowshoe hare could experience some minor temporary competition with livestock for foraging resources especially in meadows and willow/riparian areas. In addition, livestock overuse (i.e. grazing and trampling) could have minor effects on shrub and foraging habitat for snowshoe hare. However, the existing range conditions within the Rito Archuleta LAU are good and overall far better than historic conditions.

There are no other known projects or activities planned on private or state land within the Rito Archuleta LAU, in the foreseeable future which might impact lynx, their habitat, or the environmental baseline. In consideration of this cumulative effects analysis, all standards, guidelines, exemptions and exceptions within the SRLA pertaining to habitat would be met with the implementation of the Cumbres Vegetation Management Project. Therefore, the potential for cumulative effects from *future State and private land, tribal or non-Federal activities would not influence the overall determination.*

North American Wolverine (Proposed)

The wolverine is included in this analysis of federally-listed species because of a recent status change. On February 4, 2013, the U.S. Fish and Wildlife Service (FWS) issued a proposed rule to list the Distinct Population Segment (DPS) of the wolverine that occurs in the contiguous U.S. as a threatened species under the ESA (78 FR 7864). Also on February 4, 2013 the FWS published a proposed special rule under Section 4(d) of the ESA outlining the prohibitions necessary and advisable for the conservation of the wolverine (78 FR 7864). This proposed Section 4(d) rule would prohibit take of wolverine from trapping, hunting, shooting, etc., while allowing incidental take associated with management activities such as dispersed recreation, timber harvest, mining etc., if those activities are conducted in accordance with applicable laws and regulations (78 FR 7890). In the same federal register document the FWS also proposed to establish a nonessential experimental population (NEP) area for the wolverine in the southern Rocky Mountains of Colorado, northern New Mexico, and southern Wyoming. The FWS is not proposing critical habitat at this time.

Given that all potential habitat associated with the project areas is currently unoccupied by wolverines, there would be no effect on the species. However, even if the species is eventually reintroduced to or recolonizes Colorado, activities such as timber harvest are not expected to have any measureable influences on wolverines because they are not mentioned as a potential threat to the species and are included in the proposed Section 4(d) incidental take allowances

DETERMINATION FOR ALLALTERNATIVES: implementation of these alternatives; *"would not jeopardize" the wolverine* or influence any future options for achieving a self-sustaining population in the Southern Rocky Mountains.

R2 Sensitive species

The Biological Evaluation for Sensitive species considered 29 species. Species having no suitable habitat within the analysis area are not analyzed in further detail. This project would have no impact on the Great Basin silverspot butterfly, bald eagle, black swift, burrowing owl, ferruginous hawk, flammulated owl, sage sparrow, Brewers sparrow, Lewis' woodpecker, loggerhead shrike, northern harrier, American peregrine falcon, yellow-billed cuckoo, white-tailed ptarmigan, Gunnison sage grouse, mountain plover, Townsend's big-eared bat, fringed myotis, hoary bat, Gunnison's prairie dog, Rocky Mountain bighorn sheep, New Mexico meadow jumping mouse; or their habitat.

Pre-field and habitat surveys determined that suitable habitat exists for six sensitive species within the Cumbres project area (table 3-5). By category, these six species are:

- Amphibians – Boreal Toad, Northern Leopard Frog
- Avian – Northern Goshawk, Boreal Owl, Olive-Sided Flycatcher
- Mammals –American marten

These six species are further analyzed in each alternative for the Cumbres Vegetation Management Project. A more detailed analysis is included in the project Biological Evaluation.

Table 3-5-Summary of findings for Region 2 terrestrial sensitive species.

Species	General Habitat	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3- Limited Action
INSECTS				
Great Basin silverspot butterfly	Spring fed and/or subirrigated wetlands at low (7500 feet or less) elevation; larval food plant Viola nephrophylla; wet meadows interspersed with willows and other woody wetland species; adult nectar sources mostly composites .	NI	NI	NI
AMPHIBIANS				
Boreal toad *Bufo boreas boreas*	Spruce/fir near water and alpine meadows.	NI	MI	MI
Northern leopard frog *Rana pipiens*	Riparian and wetland areas.	NI	MI	MI
BIRDS				
Bald eagle *Haliaeetus leucocephalus*	Nests and roosts are usually found in open-branched trees near larger lakes, streams, rivers and reservoirs.	NI	NI	NI
Black swift Cypseloides niger	Nests behind or next to waterfalls and wet cliffs. Forages over forests and open areas.	NI	NI	NI
Boreal owl *Aegolius funereus*	Mature spruce/fir and mixed conifer forested areas with preference for wet situations (bogs or streams) for foraging	NI	MI	MI

Table 3-5-Summary of findings for Region 2 terrestrial sensitive species.

Species	General Habitat	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3- Limited Action
Burrowing owl *Athene cunicularia*	Open grasslands associated with prairie dogs. Nests and roosts in burrows dug by mammals or other animals.	NI	NI	NI
Ferruginous hawk *Buteo regalis*	Open grasslands and shrub steppe communities. Nests in tall trees or shrubs along streams or on steep slopes	NI	NI	NI
Flammulated owl *Otus flamineolus*	Depend on cavities for nesting, open forests for foraging, brush for roosting. Occupy open ponderosa pine or forests with similar features (dry montane conifer or aspen, with dense saplings).	NI	NI	NI
Sage sparrow *Amphispiza belli*	Grasslands and open situations with scattered brush and riparian scrub; preferring to feed near woody cover; strongly associated with sagebrush for breeding. Positively correlated with big sagebrush, shrub cover, bare ground, above-average shrub height, and horizontal patchiness; negatively correlated with grass cover.	NI	NI	NI
Brewer's sparrow *Spizella breweri*	Strongly associated with sagebrush in areas with scattered shrubs and short grass; to lesser extent in mountain mahogany, rabbit brush, and bunchgrass grasslands with shrubs or large openings in pinyon-juniper.	NI	NI	NI
Northern goshawk *Accipter gentiles*	Mature forest generalist. On the Rio Grande, often found in mixed conifer/aspen stands.	NI	MI	MI
Lewis's woodpecker *Melanerpes lewis*	Open pine forests, burnt over areas with snags and stumps, riparian and rural cottonwoods, and pinyon-juniper woodlands.	NI	NI	NI
Loggerhead shrike Lanius ludovicianus	Grassy pastures that are well grazed. Nests in shrubs or small trees, preferably thorny such as hawthorn.	NI	NI	NI
Olive-sided flycatcher *Contopus cooperi*	Mature spruce/fir or Douglas-fir forests with preference for natural clearings, bogs, and stream and lake shores with water-killed trees, forest burns and logged areas with standing dead trees.	NI	MI	MI
Northern harrier *Circus cyaneus*	Marshes, meadows, grasslands, and cultivated fields. Nests on the ground, commonly near low shrubs, in tall weeds or reeds, sometimes in bog; or on top of low bush above water, or on knoll of dry ground, or on higher shrubby ground near water, or on dry marsh vegetation.	NI	NI	NI
American peregrine falcon *Falco peregrinus anatum*	Cliff habitat over 200 feet high with suitable ledges for nest construction.	NI	NI	NI
Yellow-billed cuckoo (FC) *Coccyzus americanus*	Open woodland, parks, deciduous riparian woodland; nests in tall cottonwood and willow riparian woodland.	NI	NI	NI

Table 3-5-Summary of findings for Region 2 terrestrial sensitive species.

Species	General Habitat	Alternative 1 No Action	Alternative 2 Proposed Action	Alternative 3- Limited Action
White-tailed ptarmigan *Lagopus leucurus*	Alpine tundra, especially in rocky areas with sparse vegetation. Summer habitats include moist, low-growing alpine vegetation. Canopy cover of willow at winter feeding sites preferred.	NI	NI	NI
Gunnison sage-grouse *Centrocercus minimus*	Lek sites are characterized by low vegetation with sparse shrubs often surrounded by big sagebrush dominated plant communities below 9200' elevation. Brood rearing habitat is characterized by riparian vegetation of intermittent and perennial streams, springs, seeps and meadows within upland vegetation communities.	NI	NI	NI
Mountain plover *Charadrius montanus*	High plains/short grass prairie habitats, often associated with prairie dog towns. Nesting areas characterized by very short vegetation with significant areas of bare ground	NI	NI	NI
MAMMALS				
American marten *Martes americana*	Spruce/fir and mixed conifer forests with complex physical structure.	NI	MI	MI
Townsend's big-eared bat *Corynorhinus townsendii*	Forages in semi-desert shrublands, pinyon-juniper woodlands and open montane forests. Roosts in caves, mines and mature forests.	NI	NI	NI
Fringed myotis *Myotis thysanodes*	Desert, grassland, and woodland habitats. Roosts in caves, mines, rock crevices, buildings, and other protected sites.	NI	NI	NI
Hoary Bat *Lasiurus cinereous*	Primarily a solitary tree-foliage roosting bat; may be associated with any habitat type that contains trees, up to timberline (Primarily Ponderosa pine). The hoary bat probably occurs throughout Colorado in suitable habitat from the eastern plains to elevation of 10,000 in the mountains.	NI	NI	NI
Gunnison's prairie dog *Cynomys gunnisoni*	High mountain valleys and plateaus at 1830-3660 m; open or slightly brushy country, scattered junipers and pines. Burrows usually on slopes or in hummocks.	NI	NI	NI
Rocky Mountain Bighorn Sheep Ovis canadensis	Open areas next to steep escape cover (low elevation to alpine).	NI	NI	NI
New Mexico Meadow Jumping Mouse *Zapus hudsonius luteus*	Primarily associated with tall grass and sedge component in riparian areas along perennial streams; upper elevation limit suspected to be about 9000 feet.	NI	NI	NI
River Otter *Lontra canadensis*	Major river drainages, larger perennial streams with at least 10 cfs of stream flow (generally 4th order or larger); lakes and reservoirs.	NI	NI	NI

NI – No Impact; MI – May impact individuals, but not likely to result in loss of viability or cause a trend toward federal listing

Direct and Indirect Effects

Alternative 1– No Action

Under this alternative, there is no potential for direct or indirect impacts from project activities as no project would occur. None of the sensitive species analyzed would be disturbed and/or displaced. Existing canopy cover would still continue to degrade as a result of the spruce beetle infestation. However, through time, the forest would provide a patchy distribution of deadfall, standing dead and newly regenerating trees and shrubs across the landscape. Forest regeneration is expected to improve as the overhead canopy is opened and release occurs.

Large standing snags and coarse woody debris (CWD) would accumulate within the forest in large amounts in some areas. Coarse woody debris plays a critical role in supplying the type of structure needed for forested species such as the American martin, boreal owl and olive-sided flycatcher. In addition, decomposing CWD can improve soil nutrient composition and moisture retention and overall forest regeneration of herbaceous vegetation. This can provide micro habitats and burrow opportunities for the boreal toad, and improve prey species abundance for the Northern goshawk. In addition, herbaceous regeneration, especially around small bodies of water, can improve moist soil environments for the Northern leopard frog, decreasing the potential for desiccation. This alternative may decrease hiker, ATV, or snowmobile activity, because of CWD accumulation.

Overall, this alternative would allow natural disturbances such as spruce beetles to slowly re-shape the forest; providing the best opportunity for a continued and naturally created mosaic pattern across the landscape that would provide sensitive species habitat as natural processes proceed to occur.

DETERMINATION FOR ALL SENSITIVE SPECIES FOR ALTERNATIVE 1: For this project, implementation of this project provides the best alternative for forest health by allowing natural disturbances such as spruce beetles and processes too slowly shape the over health and function of the forest. Providing sensitive species and their habitat the best opportunity for a continued naturally created mosaic pattern across the landscape, providing a heterogeneous collection of habitat types as natural processes proceed to occur. Therefore, it is determined that the implementation of **alternative 1 would have No Impact on the six species analyzed**

Alternative 2 – Proposed Action

Removal of dead and dying trees could degrade habitat for boreal owl, northern goshawk and the olive-sided flycatcher within the project area. For the boreal owl, the most likely direct effect that could occur outside of the nesting season from salvage activities would be disturbance (leaving the area). However, during the nesting season (mid-April to late May), nest destruction, displacement and/or adult and nestling mortality could also occur if nesting trees are felled. Indirect effects could include the reduction in existing large diameter snags and future snag recruitment, which may influence potential nesting habitat and occupancy. The reduction of understory components such as surface litter and CWD, could also reduce habitat of the boreal owls primary prey species--the red-backed vole. However, future improvements in understory regeneration and composition due to natural regeneration and replanting can improve habitat for the red-backed vole (10 years or less) and thus improve foraging habitat for the boreal owl.

Disturbance of species such as the northern goshawk around the breeding season can be very detrimental to reproductive success. Northern goshawks are very sensitive to human disturbance within the breeding season, as goshawks can be very aggressive to any disturbance during this time period. Harvest activities during the breeding season (May thru early July) may inhibit breeding activity, cause nest abandonment or mortality and failure. However, it is expected that harvest activities would not occur until very late in the breeding season (July) when snowmelt has almost ceased and young are beginning to fledge the nest. In

addition, 70 percent of goshawk occurrences on the Forest have occurred within large mature aspen zones. Species habitat preference is expected to play a crucial role in the potential for impacts to the northern goshawks. Within the Cumbres analysis area, the predominant timber type is Engelmann spruce/subalpine fir. Goshawks will utilize this timber however, to a much lesser extent. The preferred timber type aspen is only found in small pockets and quantities with the project area. Aspen would not be harvested under any action alternative.

Indirectly, the removal of beetle killed trees, understories, regeneration and any vegetative components that might support prey base resources, could impact the northern goshawk. Reductions in prey could induce displacement of the goshawk into other areas in search of food. However, the reductions in resources are expected to be temporary. Harvested areas should rapidly convert into more open habitat in the short term and this impact could be beneficial to several avian species (goshawk and olive-sided flycatcher), because herbaceous vegetation should start to regenerate quickly. Through time, a patchy distribution of deadfall, dead standing and newly regenerating trees and shrubs would likely occur across the landscape, which should provide prey base resources for avian species.

Some areas may continue to provide suitable habitat for those species requiring closed-canopy forested areas and may even improve in quality as more CWD becomes available and the understory vegetation is released. Harvest activities can potentially cause disturbance to avian species during project implementation. There is a potential for nesting raptors and birds such as the olive-sided flycatcher to be disturbed or suffer direct mortality as the result of tree felling activities. However, this potential can be decreased by project design criteria (PDC) for avian species by the protection of active bird nests, cavities and soft snags. Habitat effectiveness may be impacted but overall the analysis area would continue to provide adequate habitat for many avian species.

Sensitive Amphibians - There is a possibility that direct boreal toad mortality could occur during harvest operations through crushing of individuals, eggs, or underground burrows by vehicles or heavy equipment. The potential for crushing can increase with the re-construction and re-opening of roads. However, the lack of both current and historic boreal toad documentation in the analysis area, this likelihood is very low. Leopard frogs are much more restricted to water than are boreal toads and are less impacted by the effects of timber harvest activity, particularly given the harvest restrictions in riparian areas.

Indirectly, the removal of a large amount of overstory would change habitat conditions on the ground and could impact boreal toad survival and reproduction by changing the microclimate within the understory. Harvest would result in a more open canopy. More openings could impact toad habitat by increasing the risk of predation and decreasing surface moisture. The loss of micro habitats and burrow opportunities may impact future survival and reproduction. In addition, the removal of forest canopies may increase the potential for desiccation in and around northern leopard frog habitat by removing the mature components that provided shade and helped maintain moisture. However, the removal of overhead canopy can subsequently cause understory release and potentially improve herbaceous regeneration, especially around small bodies of water. Therefore, improved regeneration can improve moist soil environments for the Northern leopard frog, decreasing the potential for desiccation in the near future.

Sensitive Mammals – American Martin is suspected to occur in the analysis area, since they have been documented in the Trujillo Meadows Campground. Martins may be disturbed and or displaced by harvest activities. In addition, martins can be impacted from those activities that modify late-successional stand characteristics preferred by the species and/or its food resources. Activities that modify canopy closure, snag densities, and/or ground-level CWD may be particularly detrimental to the American marten (Buskirk 2002). Timber harvest is considered the primary forest management activity that has the potential to affect the marten. The primary impacts include removal of the large tree and/or snag component, reduction in

canopy closure, and alteration of ground-level CWD complexes associated with older forest stand conditions.

Under this alternative, sufficient woody debris would remain available on the forest floor for wolverine and marten prey species and for marten denning habitat. The spatial distribution and concentration of trees remaining would continue to provide suitable foraging habitat for these species within the area of influence and project site. Canopy closure would decrease substantially as trees are removed and remaining spruce trees die. This could degrade habitat for martens as they prefer areas with overhead cover, however, they would be expected to disperse to nearby remote areas. Areas that currently have substantial understory/regeneration, preferred by martens, would be expected to release following treatments, improving the overall structural quality of marten habitat in this area within approximately 20-50 years.

Determination for all Sensitive Species for alternative 2: This action alternative would result in a given amount of habitat conversion depending upon acres harvested. For this determination, the amount of acre conversion is not significant enough to warrant a different determination between the two action alternatives. Forest Plan standards and guidelines in addition to Project Design Criteria (PDC) would help reduce potential impacts to all sensitive species. It is determined that implementation of alternative 2 ***May Impact Individuals, but is not likely to cause a trend towards Federal listing or result in loss of viability in the planning area*** (the Forest) for the species evaluated.

Alternative 3 – Limited Action

Effects of this alternative would be similar to alternative 2 for sensitive species.

Determination for all Sensitive Species for alternatives 3: As with alternative 2, this alternative would result in a given amount of habitat conversion depending upon acres harvested. For this determination, the amount of acre conversion is not significant enough to warrant a different determination between the two action alternatives. Forest Plan standards and guidelines in addition to PDC would help reduce potential impacts to all sensitive species. It is determined that implementation of alternative 2 or 3 ***May Impact Individuals, but is not likely to cause a trend towards Federal listing or result in loss of viability in the planning area*** **(**the Forest) for the species evaluated.

Cumulative Effects

The proposed project in addition to other past, present, or reasonably foreseeable activities within the analysis area would be expected to potentially have only minor cumulative impacts such disturbance and/or displacement. However, for some species like the boreal toad; the potential for species impact is unlikely since it has not been found in the area. Other species such as the Northern goshawk generally does not prefer the spruce fir zone; presence has not been documented within the analysis area and is not likely. In addition, the analysis area is adjacent to quality habitat within the surrounding Forest and South San Juan Wilderness area, for all species analyzed.

Overall, for all species, the implementation of PDC would help to alleviate some of the potential for impacts, thus overall reducing any potential for cumulative effects.

Management Indicator species

There are nine MIS species for the Rio Grande National Forest. Of those, four were dismissed from further evaluation due to lack of habitat in the analysis area or since their habitat was not being impacted by the project (Pygmy Nuthatch, Lincoln's Sparrow, Wilson's Sparrow and Vesper Sparrow).

Five species were selected for further evaluation due to both their presence within the Cumbres project area and/or potential impacts upon the habitat that they represent. The Rio Grande Cutthroat trout is addressed in the Fisheries section.

Table 3-6 is a summary of the effects of each alternative upon the MIS evaluated for Cumbres Vegetation project. Additional information for each species can be found in the Forest's MIS Species Assessments (USDA Forest Service 2003).

Table 3-6. Summary of MIS evaluations.

MIS	Habitats Represented	Rationale for Selection in Forest Plan	Rationale for Detailed Evaluation for the Analysis Area	Rationale for Dismissal From Detailed Analysis
Brown creeper	Mature to late successional spruce/fir and mixed conifer (LTAs[1] 1, 3, 13; Structure Class 5)[2]	Species has a close association with structural elements that occur under older forest conditions, including large tree diameters and older snag component. May respond to certain threats, management, and conservation activities in spruce/fir forests (Colorado Bird Conservation Plan). Resident bird less affected by management activities outside of breeding range.	To assist in monitoring whether Forest Plan standards and guidelines for biodiversity are being met, with an emphasis on snag management.	
Hermit thrush	Mature to late successional spruce/fir and mixed conifer (LTAs 1, 3, 13; Structure Class 5)	Species primarily associated with spruce/fir and is commonly associated with, but not restricted to, older forest structure. May respond to certain threats, management, and conservation activities in spruce/fir forests (Colorado Bird Conservation Plan). Tied to complex structural forest elements; may represent mature to late successional forest floor characteristics. Timber and/or fire management may affect quantity and/or quality of habitat, such as coarse woody debris.	To assist in monitoring whether Forest Plan standards and guidelines for biodiversity are being met, with an emphasis on coarse woody debris.	
Elk	Forest-wide (All LTAs)	Special interest locally (i.e., economic and recreational value). May be competing with other native ungulates and livestock. Sensitive to roads and related disturbance.	To assist in monitoring whether Forest Plan standards and guidelines are being met for wildlife, with an emphasis on providing cover to maintain screening along roads.	
Mule deer	Forest-wide (All LTAs)	Special interest locally (economic and recreational value). Sensitive to roads and related disturbance. A habitat generalist but also associated with early successional stages for forage.	To assist in monitoring whether Forest Plan standards and guidelines are being met for wildlife, with an emphasis on forest management issues that influence the early successional stages of plant communities.	
Rio Grande cutthroat trout	Riparian (LTA 10 -- Forest-wide aquatic)	Management indicator of the health of montane aquatic ecosystems Most sensitive of the salmonid species to management activities that increase sediment, reduce stream cover, create barriers to movement, or impact stream flows or water quality.		See Fisheries section.
Pygmy nuthatch	Mature to late successional ponderosa pine (LTA 5; Structure Class 5)	Cavity nester; timber and/or fire management may affect quantity and/or quality of habitat, including snags; may represent effects to other primary and secondary cavity nesters.		No habitat within analysis area.
Lincoln's sparrow	Riparian (LTA 10 -- willow)	Riparian species tied to different structural elements susceptible to grazing and other activities within riparian areas; monitored as a group with Wilson's warbler due to close habitat		Very limited habitat within analysis area. Habitat within analysis area would not be

Table 3-6. Summary of MIS evaluations.

MIS	Habitats Represented	Rationale for Selection in Forest Plan	Rationale for Detailed Evaluation for the Analysis Area	Rationale for Dismissal From Detailed Analysis
		associations with willow communities at various elevations.		impacted by timber harvest so no effect
Wilson's warbler	Riparian (LTA 10 -- willow)	Riparian species tied to different structural elements susceptible to grazing and other activities within riparian areas; monitored as a group with Lincoln's sparrow due to close habitat associations with willow communities at various elevations.		Very limited habitat within analysis area. Habitat within analysis area would not be impacted by timber harvest so no effect.
Vesper sparrow	Grasslands (LTAs 8, 9, and 12)	Uses a narrow set of habitat conditions for nesting – sparsely or patchily distributed shrubs with abundant grass cover on the Forest; may be affected by grazing activities. Indicator of upland bunchgrass/shrub communities.		Limited habitat within analysis area. Habitat within analysis area will not be impacted by timber harvest, so no effect.

[1] LTA = Land-type Association (defined in EIS, Appendix B and in the Forest Plan FEIS p. 3-41).
[2] Structure Class (defined in EIS, Appendix C and in the Forest Plan FEIS p. 3-43).

Direct and Indirect Effects

Alternative 1 – No Action

Brown creeper - A percentage of spruce/fir Forestwide will continue to be gradually impacted by beetles. Sufficient snags should remain for brown creepers to nest and forage. Horizontal cover consisting of understory vegetation and small, dense, green trees will remain. It is expected that some individuals will disperse into healthier, mature spruce-fir habitat in adjacent forests. No discernible effect on population persistence or viability at the Forest Level

Hermit thrush- A percentage of spruce/fir Forestwide will continue to be gradually impacted by beetles. The amount of coarse woody debris (CWD) is expected to increase substantially as dead trees fall over time. Horizontal cover consisting of understory vegetation and small, dense, green trees will remain. It is expected that some individuals will disperse into healthier, mature spruce-fir habitat in adjacent forests. No discernible effect on population persistence or viability at the Forest Level.

Elk - Improvement in forage would likely occur. In some areas, large amounts of CWD on the forest floor could decrease habitat effectiveness for elk. This alternative would not result in substantial change in habitat conditions or population trend Forest-wide.

Mule deer - As large spruce trees die and lose foliage, some understory plants would begin to grow, attracting mule deer. Similar to the elk, deer may avoid areas having large amounts of CWD as they would not be able to move around as easily. Overall, would not result in any noticeable change in habitat conditions or population trend.

Alternative 2 – Proposed Action

Brown creeper - Approximately 0.4 percent of spruce fir Forest-wide would be impacted by this alternative. Up to 2,498 total acres of harvesting would occur throughout the analysis area, which could negatively impact the brown creeper. Disturbance could occur from human activity associated with timber harvest. Some nest destruction could also occur with the removal of timber. Sufficient snags should remain for brown creepers to nest and forage. Horizontal cover consisting of understory vegetation and small, dense, green trees would remain. It is expected that some individuals would disperse into healthier, mature

spruce-fir habitat in adjacent forests. There would be no discernible effect on population persistence or viability at the Forest Level.

Hermit thrush- Approximately 0.4 percent of spruce fir Forest-wide would be impacted by this alternative, which could negatively impact hermit thrush. Timber harvest may increase the rate of understory release which could benefit hermit thrush. Sufficient amounts CWD would remain for hermit thrush habitat. Horizontal cover consisting of understory vegetation and small, dense, green trees will remain. It is expected that some individuals would disperse into healthier, mature spruce-fir habitat in adjacent forests. There would be no discernible effect on population persistence or viability at the Forest Level.

Elk – This alternative would not result in any noticeable change in habitat conditions or population trend. Forage would improve following timber harvest. In harvested areas, large amounts of CWD that would impede movement would be reduced. Open road density would slightly increase for the duration of the timber sale, (although these roads would not be open to the public) so this may temporarily displace elk, but only for short periods of time.

Mule deer - As large spruce trees are removed, some understory plants would begin to grow, attracting mule deer. Similar to the elk, in harvested areas, large amounts of CWD that would impede movement would be reduced. Open road density would slightly increase for the duration of the timber sale, (although these roads would not be open to the public) so this may temporarily displace deer, but only for short periods of time. Overall a slight improvement in habitat expected, however, would not result in any noticeable change in habitat conditions or population trend.

Alternative 3 – Limited Action

Brown creeper – Due to fewer acres being proposed for salvage, approximately 0.24 percent of spruce fir Forest-wide would be impacted by this alternative. In harvested areas, effects would be the same as Alternative 2 in unharvested areas; effects would be similar to Alternative 1 with no discernible effect on population persistence or viability at the Forest Level.

Hermit thrush - Due to fewer acres being proposed for salvage, approximately 0.24 percent of spruce fir Forestwide will be impacted by this alternative. In harvested areas, effects would be the same as Alternative 2 in unharvested areas; effects would be similar to Alternative 1 with no discernible effect on population persistence or viability at the Forest Level.

Elk – This alternative would not result in any noticeable change in habitat conditions or population trend. In harvested areas, forage would improve. In some areas, large amounts of coarse woody debris (CWD) could make it more difficult for elk to move around in the area, although timber harvest would decrease the amount of debris in some areas.

Mule deer –This alternative would be the same as alternative 2 in harvested area and similar to alternative 1 in unharvested areas. Overall, a slight improvement in habitat expected, however, would not result in any noticeable change in habitat conditions or population trend.

Cumulative Effects

Cumulatively, implementation of this project in addition to other activities within the analysis area would have minor incremental effects on Forest MIS. Minor cumulative effects may impact individuals but would not likely contribute to a loss of species viability of any animal species that occurs on the Forest.

Migratory Birds

Direct and Indirect Effects

Neotropical migratory landbirds (NTMB) are those that breed in the U.S. and winter south of the border in Mexico, Central and South America. Resident landbirds include those that remain during the winter period, or move to winter habitats that occur primarily within the U.S. border. Landbirds include many of our passerine songbirds, hawks, owls and woodpeckers, but do not include waterfowl, shorebirds, or colonial water birds such as coots and rails. Several landbird species may be experiencing population declines and have become an issue of international concern (Terborgh 1992, Finch and Stangel 1993).

Direction concerning landbird conservation in Forest Service Region 2 is to reference the Birds of Conservation Concern (BCC) list produced by the U.S. Fish and Wildlife Service when completing NEPA evaluations for project activities. There are 37 BCRs in North America with four of these occurring at least partially in Colorado. The Rio Grande National Forest occurs within the Southern Rockies Colorado Plateau Bird Conservation Region (BCR 16), which encompasses portions of Colorado, New Mexico, Arizona, Utah and Wyoming. Information from BCR 16 was synthesized for use in Colorado through the development of the Birds of Conservation Concern list and the Colorado Landbird Conservation Plan

Bird Conservation Plans (BCPs) have been or are being developed by every state in the nation based on the individual physiographic areas. At the finest scale of analysis, the Rio Grande National Forest occurs within the Southern Rocky Mountains Physiographic Area (Area 62) of the Southern Rockies Colorado Plateau Bird Conservation Region. Table 3-7 lists the Birds of Conservation Concern for BCR 16 as updated in December 2008, their status within the project area, and projected influence from management activities proposed within the Cumbres analysis area.

Table 3-7. FWS birds of conservation concern for BCR 16 and anticipated effects.

Species	General Habitat	Occurrence in analysis area	Effect of Project
American Bittern	Wetlands	No	Not documented on Forest. (No habitat present)
Bald Eagle	Lakes and rivers	No	Evaluated as an R2 sensitive species
Ferruginous Hawk	Prairie	No	Evaluated as an R2 sensitive species
Golden Eagle	Cliffs/grasslands	No	No habitat present
Peregrine Falcon	Cliffs	No	Evaluated as an R2 sensitive species
Prairie Falcon	Cliffs	No	No habitat present
Gunnison Sage-grouse	Sagebrush	No	Evaluated as an R2 sensitive species
Snowy Plover	Shorelines	No	No habitat present
Mountain Plover	Prairie	No	Evaluated as an R2 sensitive species
Long-billed Curlew	Shorelines	No	Migrant not documented on Forest; (No habitat present).
Willow Flycatcher	Willow-Riparian	No	Evaluated as a R2 T&E species
Juniper Titmouse	Pinyon-Juniper Woodlands	No	Not documented on Forest
Yellow-billed Cuckoo	Deciduous Riparian	No	Evaluated as an R2 sensitive species
Flammulated owl	Ponderosa pine/snags	No	Evaluated as an R2 sensitive species
Burrowing owl	Plains/grasslands	No	Evaluated as an R2 sensitive species
Veery*	Dense riparian thickets, willow-riparian	No	Rare; one 1950 record on Forest. No Effect.
Lewis's Woodpecker	Riparian Cottonwood	No	Evaluated as an R2 sensitive species
Gray Vireo*	Oak woodlands/scrub	No	No habitat present.
Pinyon Jay	Pinyon/Juniper	No	No habitat present
Bendire's	Rare species of arid areas	No	No habitat present.

Table 3-7. FWS birds of conservation concern for BCR 16 and anticipated effects.

Species	General Habitat	Occurrence in analysis area	Effect of Project
Thrasher			
Black Rosy Finch*	Spruce-fir forest; alpine	Unlikely	Presence unlikely, no effects anticipated
Brown-capped rosy Finch	Above timberline in alpine zone in cliffs, crevices; also spruce-fir forest	No	No habitat present.
Cassin's Finch	Primarily spruce-fir, also mixed-conifer forest	**Possible**	Minor disturbance and/or displacement
Grace's Warbler	Ponderosa pine	No	No habitat
Brewer's Sparrow	Sagebrush shrublands	No	Evaluated as an R2 sensitive species
Grasshopper Sparrow	Grasslands	No	Rare in SLV; Not documented on Forest. No habitat present.
Chestnut-collared longspur	Plains	No	No habitat present.

* Excluded from analysis because the species does not occur or has very rare migratory occurrence on the Rio Grande National Forest

A review of the migratory bird table indicates that five species on the Birds of Conservation Concern (BCC) List for BCR 16 are excluded from analysis because they do not occur or are considered accidental on the Forest included: veery, gray vireo, black rosy finch, Grace's warbler, and chestnut collared longspur. Other species that would not be expected to occur or do not have habitat present in the area of influence for this project include: American bittern, bald eagle, ferruginous hawk, golden eagle, peregrine falcon, prairie falcon, Gunnison's sage grouse, snowy plover, mountain plover, long-billed curlew, willow flycatcher, juniper titmouse, yellow billed cuckoo, flammulated owl, burrowing owl, Lewis' woodpecker, pinyon jay, Bendire's thrasher, Brewer's sparrow, and grasshopper sparrow.

The only species likely to occur within the analysis area is Cassin's Finch (USFWS Birds of Conservation Concern for BCR 16). Project design criteria regarding snag retention and not harvesting trees with active bird nests would help to conserve this species.

The Colorado Landbird Conservation Plan (Beidleman 2000) identified priority species and habitats for each physiographic area in the state, based on the Partners-In-Flight Species Prioritization Process. Priority habitats identified for the Southern Rocky Mountains Physiographic Area include: alpine tundra, aspen, cliff/rock, high elevation riparian, lowland riparian, mixed-conifer, mountain shrubland, ponderosa pine, sagebrush shrubland, spruce-fir, and wetlands. Table 3-8 shows the two priority habitat types that occur within the analysis area along with the species of the Southern Rocky Mountains province and their relationship to this assessment.

Table 3-8. Priority bird conservation habitats and species of the Southern Rockies Physiographic Area

Priority Habitats	BCP Priority Species	BCP Potential Issues(s)	Potential Influence from Project Activities	Effect of Alternatives
Aspen	Red-naped sapsucker Purple martin Violet-green swallow	Grazing, snag habitat, Altered disturbance regimes	No issues identified. Minor aspen component in analysis area.	No negative, but potential positive impacts (regeneration) to aspen habitat as a result of this project.

Table 3-8. Priority bird conservation habitats and species of the Southern Rockies Physiographic Area

Priority Habitats	BCP Priority Species	BCP Potential Issues(s)	Potential Influence from Project Activities	Effect of Alternatives
Spruce/Fir	Boreal owl Olive-sided flycatcher Hammond's flycatcher	Timber mgmt., snags, altered disturbance regimes	Timber harvest or natural processes could eliminate snags and/or perches for Boreal owls and olive-sided flycatchers, respectively.	Boreal owl and olive-sided flycatcher evaluated as R2 Sensitive species. Potential for temporary, minor disturbance of individuals of all 3 species. Hammond's flycatcher habitat would be degraded under all alternatives, as they prefer mature and old-growth forests. Natural and management processes change this area to be less favorable for use by this species. If this is the case, individuals would be expected to utilize nearby, more suitable habitat. Harvest of some trees with active nests could occur, causing mortality to individuals and/or eggs. This could have impacts to Hammond's flycatcher within the analysis area. However, PDC include not harvesting trees with active nests which has the potential to reduce occurrence of this type of mortality.

Alternative 1 – No Action

Extensive loss of mature spruce due to spruce beetle activity would have potential negative effects to those birds that depend on live mature or old growth forests (i.e. Hammond's flycatcher). These species would be expected to utilize other suitable habitat for as long as it is available. For species that utilize snags, additional habitat would continue to become available. Under this alternative all trees would be allowed to follow a natural progression and would be present in the area for a longer amount of time (likely 10 to 50 years, with most falling in 20-40 years (M. Tooley, personal communication 2010), similar to processes that will occur in adjacent infested backcountry and/or wilderness areas.

Under all alternatives, mature spruce trees and the habitat that they currently provide would be reduced.

Aspen is a minor component in the analysis area. It is expected conifers would continue to encroach into the clones over time though the mortality of much of the overstory conifers may create some opportunity for aspen sprouting.

Alternative 2 – Proposed Action

Under this alternative, only dead and dying spruce trees greater or equal to 8 inch dbh would be harvested; subalpine fir trees would be left, unless a specific hazard or operational purpose is identified.

Proposed harvest activities could cause some disturbance of individuals. There is the potential to impact active nests, if harvest occurred in a unit during breeding season. In harvested areas the number of snags would be reduced following harvest. However, Project Design Criteria (PDC) regarding snag retention and not harvesting trees with active bird nests would help mitigate adverse effects and conserve these species.

This alternative alone would not be expected to impact populations of migratory birds. The aspen treatments though effecting minor number of acres, could help maintain or expend the aspen clones where they now occur, which may have long term benefits.

Alternative 3 – Limited Action

Effects of this alternative would be similar to Alternative 2 for harvested areas. Unharvested units/areas would have effects similar to alternative 1.

Cumulative Effects

Selection of any of the alternatives would be expected to have similar direct or indirect impacts to any migratory birds within the area of influence. Cumulatively, implementation of this project in addition to other activities within the analysis area would have minor incremental effects on migratory birds (i.e. increased cumulative chance for disturbance or displacement. Minor cumulative effects may impact individuals but would not likely contribute to a loss of species viability of any migratory bird that occurs on the Forest.

Cumulatively, the spruce beetle infestation could have impacts to local bird populations (with some local populations increasing and some decreasing). These potential population fluctuations are more impacted by the actual beetle infestation than by associated harvest or other activities.

3.5 Fisheries

Scope of Analysis

The scope of this analysis discusses the fishery resources within the Cumbres project area. The analysis is restricted to the Cumbres analysis area boundary.

Existing Conditions

As described elsewhere in this document, there have been numerous previous activities in this analysis area. The most significant past action that has impacted fisheries across the entire forest, including the analysis area, is the stocking of non-native trout. The first documented nonnative trout stockings on the Forest occurred in 1891. Brook trout, brown trout, rainbow trout, and other cutthroat trout subspecies have been stocked in streams and lakes within the analysis area.

The stocking of nonnative trout has had the most significant effect on the current distribution of native fish. Native trout readily hybridize with other spring spawning trout, including rainbow trout and nonnative subspecies of cutthroat trout, resulting in a loss of their genetic integrity and unique phenotypic characteristics. Native trout are also subject to competition and possibly predation by sympatric populations of brook trout and brown trout. Nonnative salmonids pose a serious threat to native Rio Grande cutthroat trout distribution, although they do provide a valuable recreational fishery.

Currently, the streams and riparian areas within the project area are generally in good condition and are meeting Forest Plan Standards and Guidelines. See chapter 3 Watershed and Aquatic Resources section for detailed information on stream/riparian habitat condition and the Fisheries Biological Evaluation (project record) for project evaluation on sensitive fish species.

There are no native fish populations within the analysis area. There is very limited suitable stream habitat within the analysis area that could support a fishery although small self-sustaining nonnative trout populations are found in a couple of smaller perennial streams. Surveys in 2011 in Rio de los Pinos, located just outside of the eastern boundary of the analysis area, documented a very good brown trout fishery in the stream. Trujillo Meadows Reservoir, also adjacent to but outside of the analysis area, is stocked with various nonnative trout species by Colorado Parks and Wildlife. Surveys conducted within the last 5 years failed to document any native fish in the reservoir.

The self-sustaining nonnative trout populations within the general project area meet Forest Plan Desired Condition for supporting viable populations of desired nonnative species. The well-established non-native trout populations in Rio de los Pinos and Trujillo Meadows Reservoir also support the Regional and Forest Objectives for maintaining sport fish opportunities.

Direct and Indirect Effects

Timber harvest proposed within the analysis area could have negative consequences on trout habitat if the actions result in changed rates of sediment and nutrient delivery, or altered levels of water temperature and dissolved oxygen. Timber harvest can impact the quantity, quality, and timing of runoff. Influences may include alterations to riparian communities, loss of instream and riparian cover, increase in sedimentation, loss of stream complexity, stream fragmentation, stream bank damage, loss of large woody debris recruitment, and changes in flow and temperature regimes. Roads associated with timber harvest can affect streams and fish habitat by changing the runoff characteristics of watersheds and accelerate erosion resulting in stream sediment loading which can lead to changes in channel morphology and create movement barriers. These effects can reduce spawning, rearing, foraging and over-winter habitat by increasing flows which can lead to bank instability resulting in increased sedimentation which can fill pools and degrade spawning habitat.

Increased sediment into streams from harvest activities and road construction or use can also provide suitable habitat for fish diseases and various disease vectors. Currently, whirling disease is not known to occur in any of the streams within the project area.

Alternative 1 – No Action

No new surface disturbances from management activities would occur in any watersheds. Watersheds, stream channels, and riparian areas would be left in their existing condition. No pre-haul maintenance or road reconstruction would occur. Any road drainage problems would be left until they can be dealt with through normal maintenance operations.

The No Action alternative proposes no additional management action, although some hazard trees may be removed on an ongoing basis to protect infrastructure and for human safety. Design criteria would be implemented to address hazard tree removal. Public firewood gathering would be permitted throughout the area along open roads. Since no management actions would be implemented, there would be No Effect on the trout or their habitat within the area from such actions. Although, due to the scale of beetle activity and extensive tree mortality within the analysis area, the trout populations could still be affected by increases in erosion from heavy rainfall events and changes in seasonal run-off and stream flows. See the Watershed and Aquatic Resources section for detailed discussion regarding beetle epidemics and potential effects to watershed hydrology.

Alternative 2 – Proposed Action

This alternative proposes the highest level of management activity with approximately 70 percent of the analysis area proposed for treatment. Most salvage harvest activities, including new road construction, are on slopes less than 35 percent and would be outside of the water influence zone (WIZ) of most of the fish bearing streams and should therefore have very little direct effect on the fishery resources within the analysis area. There could be some indirect effects from sedimentation due to the increased volume of traffic on NFS roads and the use of approximately 18 miles of previously closed, non-system roads that would be opened to access the harvest areas. High use of these roads could potentially increase sedimentation from road runoff, if Project Design Criteria (PDC) are not implemented correctly.

There could be some hazard tree removal within WIZ areas that should be closely coordinated with the forest hydrologist and/or fisheries biologist as stated in the PDC (chapter 2). There could be instances where felling and leaving trees in riparian areas and/or streams could provide additional protection from high runoff or heavy riparian use and/or improve instream fish habitat. Fuel reduction treatments being proposed are well outside of the WIZs and should have no effect on fisheries.

Road work would cause some surface disturbance during pre-haul road maintenance, old, non-system road reconstruction, and construction of new temporary roads. Short-term impacts that may occur during these activities would be offset by implementing PDC's and Forest Plan standards that are designed to improve/prevent road impacts to streams and correct existing drainage problems. Therefore, it is anticipated that as the roads are upgraded and drainage issues are resolved there would be some long-term benefits to the stream corridors. However, reopening the decommissioned road that parallels Rio de los Pinos (FSR 118.1A), poses serious concern with potential impacts to the stream. This road crosses several small tributaries and numerous seeps/springs that flow directly into Rio de los Pinos; it was previously closed and decommissioned due to impacts to the stream. The old roadbed has re-vegetated and the impacts to Rio de los Pinos have been minimal since the closure. The proposed re-opening of this road is a major concern to the health of Rio de los Pinos and would require careful design and monitoring to ensure impacts to stream habitat are minimized.

Of the two action alternatives, this alternative would have the most potential to impact aquatic resources due to the overall scale of the project and the reopening of NFSR 118.1A. The impacts to overall stream health and trout populations should be minimal with implementation and full compliance with Forest Plan standards and guidelines, PDC, and R2 Watershed Conservation Practices Handbook measures.

Alternative 3 – Limited Action

All activities described under Alternative 2 would occur under this alternative, except that fewer acres and units are proposed for salvage harvest. Since fewer acres would be harvested, fewer acres would be needed for landings and fewer miles of system and non-system roads would be required, resulting in less surface disturbance. Impacts would be similar to those described for Alternative 2 with the same Standards, Guidelines, and PDC incorporated.

The most significant difference from a fishery perspective is NFSR 118.1A would not be reopened and harvest activity would not occur in units 1 and 20, which border Rio de los Pinos and its tributary, therefore potential adverse stream impacts would be minimized.

With this alternative, only 0.1 mile of new temporary road would be constructed, but there could still be some indirect effects from sedimentation from existing roads due to the increased volume of road traffic associated with the project and the use of over 9 miles of previously closed roads accessing the harvest areas.

This alternative would cause less surface disturbance from tree harvest and road construction than Alternative 2 and would therefore pose less risk to aquatic resources. There are no fish populations within the analysis area that would be impacted by management activities and the impacts to stream health should be minimal with implementation and compliance with Forest Plan S&Gs, Project Design Criteria (PDC) and R2 Watershed Conservation Practices Handbook measures.

Cumulative Effects

The stocking of nonnative trout has had the most significant effect on the current distribution of Rio Grande Cutthroat trout (RGCT). RGCT readily hybridize with other spring spawning trout, including rainbow trout and nonnative subspecies of cutthroat trout, resulting in a loss of their genetic integrity and unique phenotypic characteristics. RGCT are also subject to competition and possibly predation by sympatric populations of brook trout and brown trout. Nonnative salmonids pose a serious threat to RGCT existence.

Previous timber harvest in the area has recovered well and no noticeable impacts to the streams were documented after the decommissioning of NFS road 118.1A. Some riparian zones within the analysis area do have roads along the areas and receive recreational use such as hiking, camping, vehicle use, and

fishing. These activities can lead to loss of riparian vegetation, soil compaction, and increased sedimentation resulting in degraded fish habitat.

Increased sediment into streams from harvest activities and road construction/use could provide suitable habitat for fish disease and various disease vectors and lead to loss of overwintering and spawning habitat. Colorado Parks & Wildlife has an extensive outreach program informing anglers about aquatic nuisance species and diseases which is aimed at reducing the spread of the species/diseases by outdoor users. Currently, whirling disease is not known from any of the streams within the project area.

3.6 Rangeland

Scope of Analysis

This analysis focuses on the effects to rangeland and rangeland management from the proposed management of timber stands within the project analysis area boundary.

Existing Conditions

Past permitted livestock grazing has been somewhat limited within the analysis area. Permitted livestock grazing has been limited to natural parks, meadows, and previously harvested timber areas. Domestic livestock grazing has occurred in the area of the Cumbres and Wolf Creek Cattle and Horse (C&H) Allotments since the late 1800's.

There are not any substantial dispersed campsites where horses or other recreational livestock are brought in this analysis area. Therefore, recreational livestock impacts to the vegetation are minimal.

As in the past, current livestock grazing within the analysis area is limited to natural parks, meadows, and previously harvested timber areas. The analysis area lies within the Trujillo Meadows Pasture of the Cumbres C&H Allotment and the northeast corner of Pasture #4 of the Wolf Creek C&H Allotment. Within the analysis area, there are 923 acres mapped as suitable rangeland (Forest Plan Suitability analysis) for cattle. Of these 923 acres, 668 acres are mapped as transitory rangeland and 255 acres are mapped as primary rangeland. Access to the analysis area for livestock management is primarily along the existing road system.

There are 2530 cow/calf pairs that are permitted to graze on the Cumbres-La Manga C&H Allotment and within the Trujillo Meadows Pasture. Currently there are 133 cow/calf pairs permitted on the Wolf Creek C&H Allotment and Pasture #4. Approximately 2,000 to 2,500 Cumbres and 20 to 60 Wolf Creek cow/calf pairs are present in the analysis area during the approximate 25 days each grazing season.

There is a noteworthy livestock management concern within the analysis area. This concern is the interchange of livestock between the Cumbres-La Manga C&H Allotment and the Wolf Creek C&H Allotment. This may be partially due to cattle's natural instincts to discover new grazing areas. However, it is most likely due to the lack of any real man-made or natural barrier for cattle.

The Cumbres range fence (improvement number F-36), Cumbres/Wolf Creek North Boundary Fence exists between the two allotments. Originally, when this fence was constructed, it tied into what seemed to be a natural barrier of thick timber. After a while, livestock began to circumvent this fence. The fence was no longer serving a purpose. Consequently, the fence was allowed to fall into a state of severe disrepair.

The fence needs to be reconstructed in a more functional location to restrict livestock movement. A new fence would alleviate this problem. See figure 3-5 for the location of the existing fence and the proposed location(s) for a new fence.

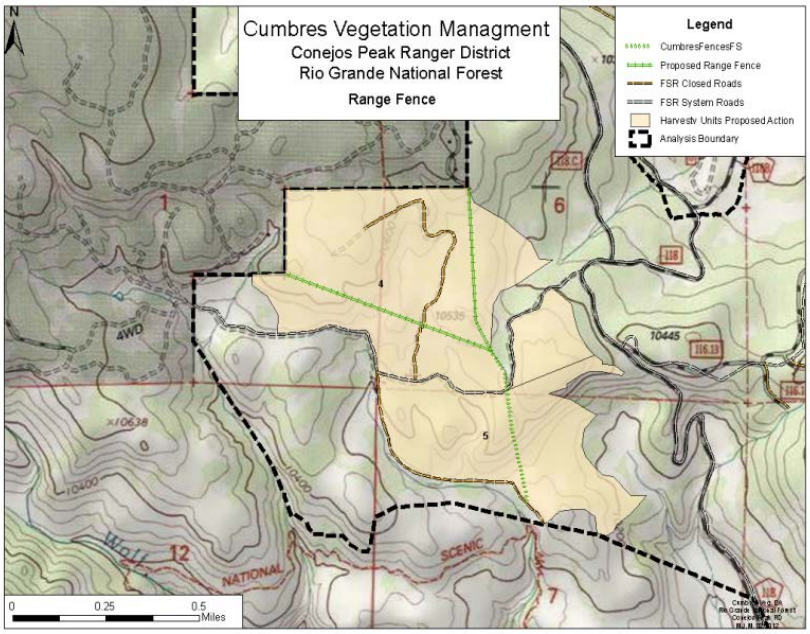

Figure 3-5. Range fence relocation options.

Direct and Indirect Effects

Alternative 1 – No Action

Under Alternative 1, the forested areas heavily impacted by spruce beetle would likely serve as transitory range for several years until the trees begin to fall and livestock can no longer access the area. Some of the existing suitable rangeland may also become inaccessible due to barriers to livestock movement created by falling trees.

If a severe wildfire were to occur in the areas heavily impacted by spruce beetle, a type conversion to grassland similar to the spruce-fir forest burned in the 1870s Osier fire would be a likely outcome. This would result in an increase in primary range in both the Trujillo Meadows pasture and Pasture #4.

The management concern of livestock traversing the allotment boundary would persist if no action is taken. If the existing fence is repaired and a new fence is constructed as planned (see map), additional work would be required to clear a corridor wide enough to protect the fence from damage from falling dead trees. A swath of cleared timber at least ten feet in width along the length of the fences would be required. Since most or this entire fence is beyond the allowable distance for firewood cutting, the cut timber would most likely go unharvested. The new fence, along with the existing fence would be subject to episodes of downfall by surrounding snags. Therefore, the snags falling would make maintenance on the new and existing fence cost prohibitive.

Alternative 2 – Proposed Action

As timber is harvested, it may open areas to livestock grazing that were not available before. The reduced canopy would allow space and light for increased grass and forb production. Improved roads, as well as timber removal, would provide new avenues for livestock to access different areas of the pasture. However, increases in forage availability due to timber harvest would not result in an increase livestock numbers.

Thus, the abundant forage would only be temporary (transitory rangeland) in nature. These sites would eventually return to timber-dominated stands. (USDA Forest Service 1996).

Even though the newly created transitory rangeland is temporary in nature, it would become a desired grazing location for permitted livestock for many reasons. For example, in times of drought, these areas are less impacted by drought and continually provide lush forage due to the protection from the sun and wind. These areas usually have an ample supply of water in the form of creeks, ponds, springs and seeps, which provide for abundant plant growth as well as providing water for livestock. The increased forage production in these areas would improve livestock distribution within the pasture. The effects of the increased transitory rangeland may carry on for many years though the herbaceous vegetation and increased access would gradually decrease with the process of forest succession.

There would be an indirect effect to rangeland management within the due to the need to manage permitted livestock more intensely to prevent damage to forest regeneration. Project Design Criteria (chapter 2) outline the management tools that would be implemented to protect forest regeneration.

Under this alternative, trees greater than 8 inches dbh could be removed under a timber sale contract in order to protect the existing and planned new livestock fence (figure 3-5) and smaller diameter trees could be cut, lopped, and left in place, as needed, thereby reducing fence maintenance needs and increasing its cost-effectiveness.

Alternative 3 – Limited Action

The same direct and indirect effects as Alternative 2 would apply in the treated areas. The same direct and indirect effects as Alternative 1 would also apply in the untreated areas. However, with a reduced number of acres harvested under this alternative, the magnitude of the direct and indirect effects to rangeland or rangeland management on the Trujillo Meadows pasture of the Cumbres- La Manga C&H Allotment the northeast corner of Pasture #4 of the Wolf Creek C&H Allotment would also be reduced.

Cumulative Effects

There would be no cumulative effects to rangeland or rangeland management within the analysis area.

3.7 Noxious Weeds

Scope of Analysis

The scope of this analysis is for noxious weeds in the Cumbres Vegetation Management Project analysis area and the haul routes to Colorado Highway 17.

Existing Conditions

All infestations that have been located and/or treated within the analysis area have been alongside roads or areas of disturbed soils. Road construction and maintenance is currently the primary activity that has had impacts to the vegetation and soils within the analysis area.

Observations have identified Canada thistle (*Cirsium arvense*) as being the only noxious weed species present in the analysis area. There have been very few sites of Canada thistle located in the analysis area. The treated sites have been very small in size (less than 1 acre). Since this area has relatively small infestations of Canada thistle, the management strategy is eradication rather than containment.

Direct and Indirect Effects

Alternative 1 – No Action

This alternative would have a low risk for noxious weed spread and/or introduction since it would entail the least amount of soil disturbance. Consequently, less equipment and activities in the area would also help diminish opportunities for noxious weed spread and/or introduction.

However, a low risk of spread and/or introduction of noxious weeds would exist. Some of the existing road infrastructure would still be maintained periodically. This involves periodic soil disturbance along roadways by heavy equipment. The machinery may serve as a mechanism for weed seed transport. Established noxious weed infestations, if not treated, would likely continue to spread and provide a seed source for new infestations.

Other activities and users of the area may also be carriers of weed seed and may cause soil disturbance that may contribute to the establishment and/or spread of noxious weeds. There would also be a certain amount of natural soil disturbance from falling trees, wildlife burrowing, and other small disturbances and natural weed seed dispersal from wind, water and wildlife. Consequently, without the project implementation, monitoring of the area would be of lower priority and any additional funding that may be generated by the project would not be available for noxious weed control.

Alternative 2 – Proposed Action

This alternative would have a moderate risk for noxious weed spread and/or introduction. Since there are populations of Canada thistle in and near the area, a seed source is present. Aside from normal road maintenance, there would be an increase in soil disturbance from road reconstruction and maintenance, skidding, landing construction, and pile burning. Logging operations offer several well-known opportunities to increase the potential for weed introduction and spread. These include:

- If road maintenance and construction requires fill and road base material, such as gravel, from an outside source; this material is a potential source of noxious weed seed.
- Increased activity with haul trucks, pickups and heavy equipment can heighten the possibility for transport of weed seed;
- Soil disturbance from log skidding and other off-road equipment can transport seeds into disturbed areas;
- Log skidding may also present an opportunity for noxious weed establishment away from main roads; making it more difficult to locate infestations in their early stages.
- The burning of slash piles is also a disturbance. If the fire is severe, like the burning of landing piles, naturally occurring vegetation can be eliminated, thus rendering those patches of land vulnerable to noxious weed invasion.

Project Design Criteria (PDC) included in chapter 2 have been shown to be effective measures to minimize the risk caused by these activities. The following factors allow the project analysis area to be ranked as moderate risk for noxious weeds rather than high risk are:

- Canada thistle is the only noxious weed known to exist in or near the area;
- Canada thistle is not very common;
- Canada thistle is very treatable and easy to control if caught early;
- PDC are in place to reduce the potential of any new weed species and the spread of Canada thistle;

- Disturbed areas would be monitored for weeds and treated *before and after* the project is completed.

Alternative 3 – Limited Action

This alternative would have the same effects as alternative 2, with a moderate risk for noxious weed spread and/or introduction. However, the since the scope of alternative 3 is only approximately 62 percent of that of alternative 2 there would be less disturbance by logging activities which would reduce the potential for noxious weed spread and establishment.

Cumulative Effects

There may be cumulative adverse effects to the analysis area from all alternatives due to the potential increase of Canada thistle and/or introduction of new species of noxious weeds and considering the other activities in the vicinity. Noxious weeds such as Canada thistle are opportunistic and will establish thriving colonies where the naturally occurring vegetation has been weakened or eliminated. Fire impacted landscapes and mechanically disturbed soil are prime locations for noxious weed establishment. Continually and severely over grazing an area will also create an environment which is conducive for the establishment and spread of noxious weeds. Presently, the most substantial areas of disturbed soil in the analysis area are the regularly maintained NFS roads. There have not been any recent fires of any consequence in the area. However, occasionally lightning will ignite small fires which could potentially become larger. The season of use for permitted livestock in the analysis area is approximately 25 days. Extensive areas of severe over utilization have not been observed.

3.8 Threatened, Endangered, and Sensitive (TES) Plants

Scope of Analysis

This analysis discusses plants that are Threatened (T), Endangered (E), Proposed, or Forest Service designated Sensitive. The analysis area for this discussion is defined by the areas proposed for management treatment under the action alternatives

Existing Conditions

Previous timber harvest activities are described in the Forest Management section. Other on-going activities are also described in other sections of chapter 3.

There are presently no reported records or suspected occurrences of T or E plants on this Forest. T and E plants in Colorado have unique habitats or ranges that do not occur on this Forest. There are also no plants Proposed for listing by the US Fish and Wildlife Service that occur on the Forest. Therefore, no further effects analysis was conducted.

None of the areas proposed for management treatment contain documented Sensitive plant species. There are five Sensitive plants suspected to have habitat in the areas proposed for treatment, based on habitat affinity (table 3-9).

Direct and Indirect Effects

The analysis below is a summary from a Biological Assessment / Biological Evaluation (BA/BE) for plants that was prepared specifically for this project and is part of the project record. None of the alternatives would be expected to result in significant direct, indirect, or cumulative effects.

Alternative 1 – No Action

This Alternative proposes no new management actions. There are no current or foreseeable future actions that would be expected to impact sensitive plants. Therefore, there would be no direct, indirect, or cumulative effect anticipated on any Sensitive plant species.

Alternative 2 – Proposed Action

Since both action Alternatives propose some level of timber harvest, planting, and road work, the effects are considered equivalent for this analysis since they affect the same habitat (i.e. there is no real distinction of effects between alternatives for this analysis area). Proposed actions would not impact any documented Sensitive plant populations. Potential habitat exists for five sensitive plants in the proposed treatment areas.

Four species were judged to be at such low risk from the proposed actions due to their habitats that there would be no direct, indirect, or cumulative effect. One species (assuming potential habitat is occupied) was judged to be directly, indirectly, or cumulatively affected (table 3-9). Direct effects from proposed actions could include clipping, crushing, or burning individual plants. Indirect effects could arise from changes in nearby canopy cover of associated vegetation due to direct effects. However, the effects of this are unknown. Most of the analysis area proposed for treatment has had past timber harvest activities.

Table 3-9. Sensitive plants suspected in the treatment areas, effects determination by alternative.

Scientific name	Habitat Description	Determination[1] Alternative 1	Determination[1] Alternative 2 and 3
Eriophorum altaicum var. neogaeum	Subalpine/alpine wetlands & riparian areas > 12,000 ft. on RGNF	NI	Ni
Eriophorum chamissonis	Fens or boggy areas 10,500 to 12,500 ft.	NI	NI
Eriophorum gracile	Fens, wet meadows, pond edges 8,000 to 12,000 ft.	NI	NI
Machaeranthera coloradoensis	Gravelly grassland slopes 8,500 to 12,500 ft.	NI	MAII
Salix arizonica	Subalpine seeps, wet meadows, & along streams. 10,300 to 10,700 ft.	NI	NI

[1] NI = No Impact; ;MAII = May adversely impact individuals, but not likely to result in a loss of viability on the Planning Area, nor cause a trend to federal listing or a loss of species viability range-wide.

Alternative 3 – Limited Action

See discussion under Alternative 2.

Cumulative Effects

Cumulative effects would be a very small, incremental increase in ground disturbance on potential Sensitive plant habitat affecting Federal lands. Implementing any action alternative would likely have a minimal impact on these plant species by following PDC (chapter 2) along with Forest Plan standards and guidelines pertinent to ground-disturbing activities. Overall, cumulative effects tied to other past, present, and foreseeable activities in the analysis area would be expected to be minor.

Physical Resources

This section summarizes the potential effects on physical resources. Complete reports are located in the project record.

3.9 Hydrology, Watershed, Aquatics

Scope of Analysis

The Cumbres project analysis area lies within three, 6th level watersheds: Headwaters Rio de Los Pinos (130100050201), Toltec Creek-Rio de Los Pinos (130100050203), and Wolf Creek (130201020203). All stream channels (perennial, intermittent, and ephemeral) on the National Hydrography dataset (NHD) are shown in Figure 3-6. Rainfall, snow melt, and groundwater are the primary components of stream flow in the area. There are also one perennial ponds and one wetland located in the analysis area (units 6 and 12).

Annual precipitation in these watersheds varies from about 24 to 48 inches, with the proposed harvest units receiving about 28 to 40 inches. Snowmelt, during the spring and early summer, is the main source of rise and fall of the hydrograph. During the rest of the seasons, stream flow comes from seepage and groundwater discharge as baseflow. Several springs, located at valley bottom, were found to discharge into intermittent/perennial streams.

A method described in the Forest Plan FEIS (pages 3-265 to 3-269) was used to evaluate watershed condition, adding up acreage of surface disturbance. Watershed analysis on the Forest is focused on the 6th level. However, watersheds with high acres of disturbance or with known higher disturbances that could be masked were broken down to the 7th level to ensure watershed protection. The 7th level sub-watershed within the Headwater Rio de los Pinos (HUC: 13010005050101) is the one with known higher disturbance and is designated as a watershed of concern.

Existing Conditions

Current watershed disturbance in the three 6th level watersheds (figure 3-6) is below Forest Plan concern levels (<15% of a watershed area in an equivalent roaded area). The concern level for sensitive watersheds is 10%. If disturbance exceeds concern levels, watershed health must be carefully evaluated to determine current condition; management activities are not constrained beyond normal Forest Plan limitations, if stream and watershed health is good. However, if stream health has been diminished, the Forest must restore impacted areas and prevent new surface disturbance that could degrade stream health further.

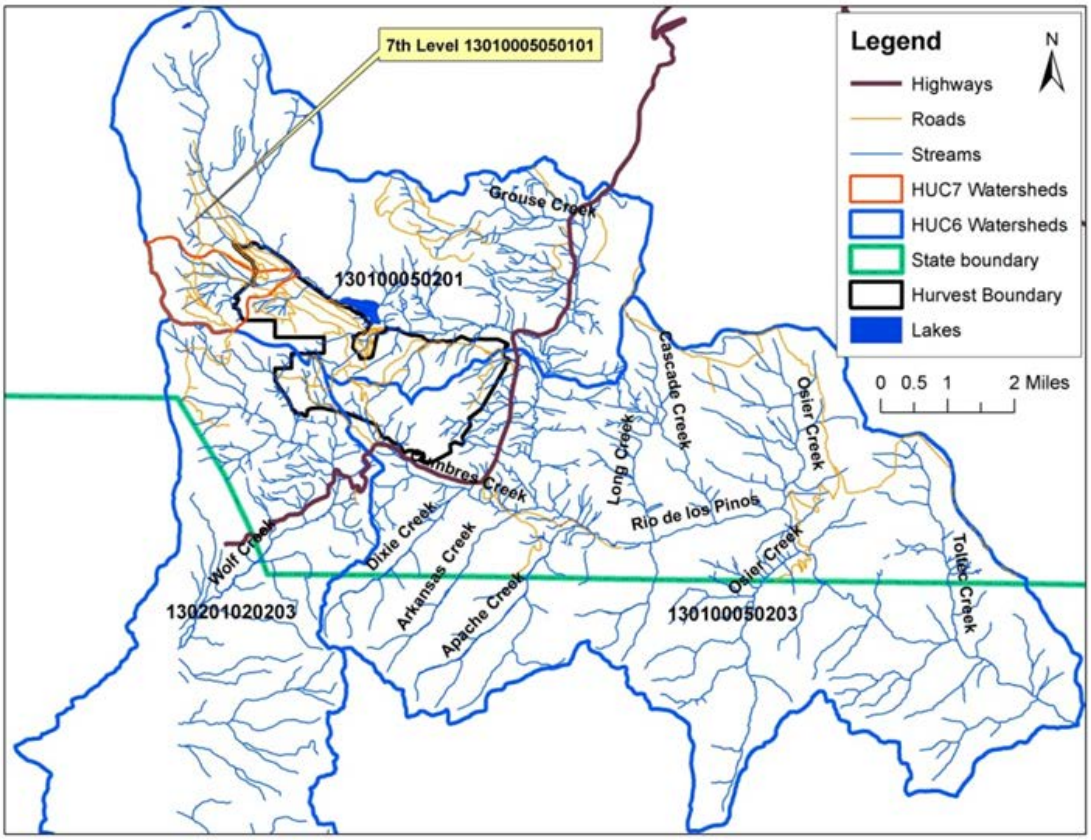

Figure 3-6. Analysis area watersheds showing all stream and drainage channels.

Connected disturbance or connected disturbed area (CDA) was analyzed using a stream crossing count method (new crossings counted, divided by total and multiplied by 100 to get percent increase). Forest service guidelines recommend limiting CDA so that it doesn't expand by more that 10 percent.

HUC 7 Watershed of Concern (13010005050101*)* - This sub-watershed is considered a "watershed of concern" because of past timber harvests and road building. When 50 percent of the total watershed area is within 100 feet of a buffered stream, the watershed is considered as a "sensitive" watershed. This watershed is considered a "sensitive" watershed due to the high percent (50.7 percent) of water influence zone area as compared to the total watershed area. Therefore, the disturbance level for the "watershed of concern" designation is 10 percent instead of 15 percent (RGNF Forest Plan 1996).

The "watershed of concern" designation does not preclude new land disturbance within the watershed, but it does require specific watershed analysis prior to any new land disturbing activities (Dobson 1996). In the summer of 2011, the sub-watershed was assessed to determine current stream health and to identify problem areas that may need restoration or additional Project Design Criteria (PDC) to correct a stream health problem. Spruce beetle mortality has resulted in a high basal areas loss, but streams remain healthy and stable; stream width or gradient have also not been affected to date.

In general, fine sediment sources are limited to a few livestock trail crossings and some steeper slopes where vegetation is sparse. A heavily used dispersed campsite has impacted bank stability on one of the upper stream reaches in the sub-watershed. Rill and gully sources were not seen. Sediment impacts of road crossings on the smaller tributaries are minor. Good vegetation cover is present on several roads in most parts of the watersheds. Stream assessments indicate that current input of fine sediment into streams in this

watershed from previous forest management activities appears to be minor and not a major factor influencing fine bed load in streams.

Road Density – Table 3-10 shows acres, square miles, road miles, and road density for the watersheds in the project analysis area.

Table 3-10. Road density values by watershed.

Watershed Name (HUC#)	Watershed area ($miles^2$)	Open roads length (miles)	Decommissioned road length (miles)	Total road length (miles)	Road Density	Road Density classi-fication
Headwaters Rio de Los Pinos (130100050201)	25.56	33.70	7.91	41.61	1.63	Moderate
Toltec Creek-Rio de Los Pinos (130100050203)	51.22	1.88	0.00	1.88	0.04	Low
Wolf Creek (130201020203)	28.14	23.34	0.00	23.34	0.83	Moderate
7^{th} Level (13010005050101)	1.67	6.34	0.77	7.11	4.27	High

Streams in the three watersheds drain off the steep areas into the Rio de Los Pinos, Cumbres Creek, and Wolf Creek. The streams typically transition from an A-stream type in the higher elevations and steeper slopes to B- and E-types in the middle and lower reaches. Substrate on the intermittent/perennial streams is dominated by cobble, gravel, boulders, and finer material. Field review shows that the higher elevation A-type channels are predominately steep, without a floodplain, and mostly intermittent on the upstream reaches. These channels, which are dominated by boulder and large cobble substrate and having large woody debris, show stability and are resilient to management.

Stream Channels - Stream health was evaluated by comparing characteristics between streams in the project area and reference streams with the same Rosgen classification or comparing stream reaches above and below Forest management disturbance. Throughout the project area, these streams currently have stable E and A/B channel types. Within the project area, stream banks are meeting Forest Plan guidelines for channel stability; channel substrates are clean from silts and clays with minor exceptions.

Water Quality - The Clean Water Act (CWA) requires that chemical, physical, and biological integrity of all waters, stream channels, and wetlands be protected. There are no water bodies in the analysis area that are listed as impaired or threatened for water quality on the Colorado 303(d) list. No streams in the vicinity of the analysis area were listed on the 305(b) list; therefore meeting designated uses (Colorado Water Quality Control Division 2010).

Water Quantity/Yield -The beetle epidemic is likely to result in some increases in water yield, although this increase is unlikely measurable at this time. Since the spruce trees are in the process of dying, many still have green needles and take-up water for transpiration. As trees start to fade, the water intake is no longer occurring and may result in increased water yield. Field assessments did not find any indicators of negative stream effects from increased water yield. The action alternatives only propose to treat dead and dying stands. Therefore, any potential increases in water yield are likely already being realized from stand mortality.

Steambank Condition – Based on field surveys documented in the project record, overall, streams in the analysis area are in a robust condition with healthy riparian vegetation that provides good stability and has a high buffering capacity (i.e. photo 8 below). Coarse woody debris was prominent in some streams.

Exposed soils were observed on one tributary stream in watershed 130100050201 (photo 11 below). No rills or gullying was found. Fine sediments sources were limited to a few livestock trails or areas with sparse vegetation.

Photo 8 UTM: 373454-4100742 (DS)

Photo 11 UTM: 372152-4100565 (DS)

Road-Stream Interactions -

Watershed 130100050203, tributary to Cumbres Creek (in Unit 11)- a short portion of this intermittent/perennial tributary flows parallel to NFS Road 118, resulting minor sediment impacts on this small tributary of Cumbres Creek (Photo 21 at right).

Watershed 130100050201 tributaries - NFSR 116 – road crosses all tributaries (Units 12 and 13). Riparian vegetation provides a good buffer to fine sediment. Large woody debris is present on most of the channels (no photo).

Photo 21 UTM: 370977-4099405 (DS)

Watershed 130201020203, Wolf Creek Tributary – NFSR 119D - Due to an undersized or improperly installed pipe culvert, streamflow is blocked and the creek runs on the surface of the road, leaving the natural pathway, for about 20 feet. This condition contributes additional sediment load and impacts the water quality of the stream. In addition, excessive sediment deposit, transported from the nearby roads and trail crossing sites, was observed on this tributary (Photos 27 and 28, below).

Photo 27 UTM: 369939-4099286 (DS)

Photo 28 UTM: 5cc 369816-4099274

Table 3-11 below shows the watershed acres, disturbed acres since 1980, and percent of each watershed in the Cumbres analysis area.

Table 3-11. Past and proposed disturbance acres and percentages, by watershed

Watershed HUC	Activities since 1980 (acres)	Watershed area (acres)	Watershed area in analysis area (acres)	Percent of watershed in analysis area	Percent of analysis area in each watershed
Headwaters Rio de Los Pinos (130100050201)	3,594	16,356	1,964	12.0	55.4
Toltec Creek-Rio de Los Pinos (130100050203)	4,112	32,770	335	1.0	35.2
Wolf Creek (130201020203)	355	18,006	1,248	1.9	9.4
Total	**8,061**	**67,131**	**3,546**	**-**	**100.0**
7th Level watershed (13010005050101)	302	1,066	159	14.9	4.5

Overall, streams within watersheds are healthy. Sediment sources associated with current system roads or other surface disturbances are minor. Most stream banks are stable, with healthy riparian vegetation in proper functioning condition present along intermittent and perennial stream reaches.

No unstable stream banks were found from previous harvest activities or within proposed harvest units. Although watershed condition has been affected by past activities, watershed improvement projects completed in the past, and natural recovery since timber operations were conducted, contribute to the present healthy watershed condition

Direct and Indirect Effects

Alternative 1 – No Action

Natural effects to aquatic ecosystem would continue with minor additional disturbance from ongoing activities (firewood cutting, road maintenance, hazard tree cutting, livestock grazing). Vegetation that has become established on some existing gated (closed) or decommissioned roads and skid trails would

continue to contribute to the capture and infiltration of water. Routine road maintenance would occur periodically and be designed to minimize effects on sediment inputs into stream channels. No additional connected disturbance area would be added to any of the watersheds. Stream channels, wetlands, and riparian areas would remain in their existing condition. Less emphasis would be placed on identifying and correcting existing road erosion problems.

There would be an increased public safety hazards and potential damage to infrastructure. Loss of live basal area due to spruce beetles has already occurred to varying degrees. This will eventually increase downed woody material across the area and could result the potential for increased water yield. The effect would be higher for the 7th level watershed of concern, where much of live basal area has been lost.

Snow accumulation and melting is expected to change as the trees die and lose needles (Pugh and Small 2011). The length of time that dead trees continue to have needles that capture snowfall and amount of understory vegetation are key factors that can affect the amount of increase in streamflow. In high snow years, dead stands behave similarly to live stands due to the ability of large snowfalls to exceed the interception capacity of the canopy (Boon 2008). Carlson (2008) summarized research findings related to beetle epidemics and potential effects to watershed hydrology. Overall, effects of tree mortality dependent on forest type, percentage of trees killed, and annual precipitation. Unlike clearcutting or severe wildfire, bark beetle-killed stands can retain a hydrologically functional secondary structure following beetle kill (Schnorbus 2011). The presence of such multi-story secondary structure can mitigate the effects of beetle-kill. However, in any forest area that has high mortality, potential fire effects due to fuel loading are a concern. Although the likelihood of a wildfire start is small, severe watershed damage could be increased as fuel loading increases and a fire would occur. Stream water temperature would increase slightly along reaches where canopy cover is lost due to spruce mortality.

In the Cumbres project area, it is likely that moderate changes in hydrology may occur naturally on the 7th level sub-watershed where mortality is high, but on a 6th level watershed these changes would probably be very low at current infestation rates. However, if infestations spread to large areas of the watersheds, cumulative effects to the hydrologic system are possible. Effects to stream stability due to a moderate increase in flow are dependent on stream and riparian characteristics. Streams with coarse bedload and banks with good riparian vegetation can withstand an increase in flow better than streams with finer bedload, especially if bank stabilizing vegetation is impaired or lacking.

Alternative 2 – Proposed Action

The total watershed area disturbance (dead trees harvest, fuel treatments, and public firewood) for Alternative 2 would be up to 2,766 acres. The areal and percentage disturbance of the watersheds, distributed to each 6th and 7th level watersheds, are shown in table 3-12. Although more area would be disturbed on the Headwater Rio de Los Pinos watershed, higher proportion of disturbance would occur on the 7th level sub-watershed.

Alternative 2 has the most mileage of proposed haul routes, opening of closed roads, and new temporary road construction of the action alternatives and would have the highest total watershed disturbance area. Some surface disturbances would occur from road construction or reconstruction and log skidding. According to the recent Rio de Los Pinos timber harvest analysis (2010), past road equivalent disturbance level on the 7th level watersheds is about 16 percent. Proposed activities would add about 1 percent road equivalent disturbance. Following implantation of this alternative, the cumulative total road equivalent disturbance would be approximately 17 percent, which is greater than the 10% concern level for sensitive watersheds. Another factor used in watershed ratings is amount of disturbance in the water influence zone (WIZ), mainly roads. The amount of road disturbance in the WIZ of the 7th level sub-watershed is 7.4 percent, under the 10 percent concern level for this parameter. Adequate buffering and additional Project

Design Criteria in the WIZs would prevent eroded sediments from finding their way into stream channels and wetlands.

The previous timber harvest (Rio De Los Pinos Vegetation Management Project 2010) analysis shows that total disturbance within the Headwater Rio de los Pinos 6th level watershed would remain under the 15 percent concern level. This alternative would add about 1.0 percent road equivalent disturbance, which would add little to the past total disturbance level. The other two 6th level watersheds have much less total disturbance level, well below 15 percent.

Table 3-12. Alternative 2 watershed disturbance acres and percentages.

	Headwater Rio de Los Pinos (130100050201)	Toltec Creek- Rio de Los Pinos (130100050203)	Wolf Creek (130201020203)	7th level sub-Watershed (13010005050101)
Total watershed area (acres)	16,356	32,770	18,006	1,066
Proposed disturbance area (acres)	1,532	974	260	124
Percent proposed disturbance area to watershed area	9.4	2.60	1.4	11.7
*Percent proposed road equivalent disturbance area to watershed area	0.94	0.26	0.14	1.17

** Total equivalent disturbance acreage (as related to road disturbance) within a timber harvest project is calculated as 10% of the total harvest unit area.*

Connected disturbed area (CDA) would increase by 13 percent for the Headwater Rio de Los Pinos, 8 percent in the Toltec Creek – Rio de Los Pinos, and 0% in the Wolf Creek watersheds. The increase in the Headwaters of the Rio de Los Pinos would exceed the recommended increase, while the other two watersheds would remain below this limit. The increase in CDA would occur on currently closed or decommissioned roads; these roads would be closed or decommissioned at the completion of the project which would return the CDAs to existing conditions.

Water Quality - The Clean Water Act requires that chemical, physical, and biological integrity of all waters, stream channels, and wetlands be protected. Forest Plan standards and guidelines and PDC would provide that protection and impacts are expected to be minimal. Standard project design criteria prevents skidding logs down stream courses and keeps heavy equipment a safe distance from channels. All surface disturbances would be adequately buffered to prevent direct impacts to the water influence zone (WIZ), floodplains, wetlands, and riparian areas. Figure 3-7 shows a representation of protected water area buffered as required by PDC.

Water Quantity/Yield - Recent studies show a potential for greater water yields following harvesting of a large percentage of dead trees in a beetle killed forest (Schnorbus 2011; Carlson 2008). However, increases in peak flows usually diminish with decreasing percentage of watershed area harvested (Grant et al. 2008). The harvest of dead trees eliminates interception of precipitation and shading which slow snowmelt. Understory can be removed and the amount of fine and CWD is altered. In addition, compaction in skid trails, landings, and roads can affect overland flow, routing runoff to streams. Although there is an extensive study on forest harvest effects on stream channels, it is uncertain that there is evidence of a direct correlation between peak flow changes due to forest harvest alone and changes to the physical structure of streams (Grant et al. 2008).

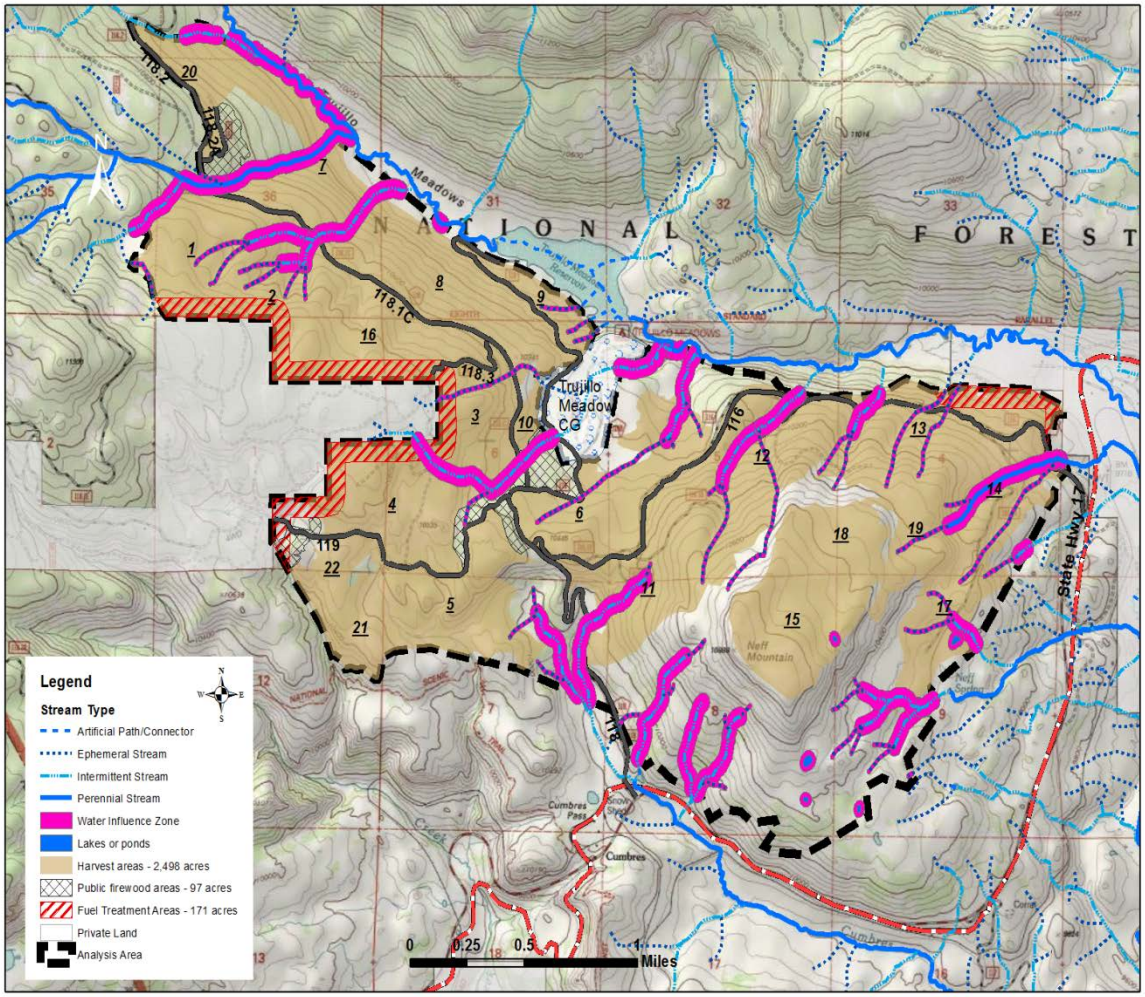

Figure 3-7. Representation of 100 foot Water Influence Zone (WIZ) buffers for wetlands, perennial, and intermittent streams.

Timber harvest alone has rarely initiated large amounts of runoff and surface erosion unless roads and skid trails are connected to streams (Litschert and MacDonald 2009). The proposed salvage cut typically disturbs only a portion of the harvest unit, and this would reduce the likelihood of overland flow and rill initiation. However, roads and skid trails, if connected to streams, may initiate rill and surface erosion and delivery of sediment loaded runoff to streams. Sediment delivery from timber harvest may be further reduced by locating skid trails away from water influence zone (WIZ), increasing the frequency of water bars, maximizing surface roughness downslope of water bars, and promptly decommissioning skid trails following harvest (Litschert and MacDonald 2009).

Few segments of existing system road to be reopened are within the WIZ (within 100 feet) of small perennial streams (see figure 3-7). These areas would be the focus of inspections by hydrology or soils specialists or their designees to ensure sediment sources are disconnected from the stream channels. Hardening, filter fence, timber slash windrows, and straw wattles would be used as appropriate where drainage cannot be directed to adequate buffer strips along these reaches. Following timber and reforestation operations, new temporary roads constructed for this project would be closed and

rehabilitated. All temporary roads would be closed and rehabilitated. This would further reduce long-term sediment sources that could find their way into stream channels.

HUC 7 Watershed of Concern- Disturbance levels in this sub-watershed are greater than the 10 percent concern level for sensitive watersheds and disturbance acreage would increase. Stream health was carefully assessed during the past timber harvest analysis. As described previously, stream health was determined to be robust and has recovered well from past disturbance. Forest Plan standards and guidelines and additional PDC (chapter 2) and monitoring would ensure impacts to stream health in this small watershed are minimal and deteriorated stream health would not be expected.

Alternative 3 – Limited Action

The total watershed area disturbance (dead trees harvest, fuel treatments, and public firewood) for Alternative 3 would be up to 1,793 acres. The areal and percentage disturbance of the watersheds, distributed to each 6th level watersheds, are shown in table 3-13. In this alternative, no disturbance would occur on the 7th level watershed of concern. Eliminating the 7th level watershed and other parts of the watersheds from activities would result in 973 fewer acres of surface disturbance area under this alternative.

Impacts from timber harvest and road work would be similar to impacts described for Alternative 2, except temporary roads needed would be less. Less surface disturbance would occur in the watersheds with most activity occurring in the Headwater Rio de Los Pinos watershed. The risk of direct impacts to watershed and stream health would still be within acceptable limits as current standards and guidelines and PDC are implemented. Similar to alternative 2, Project Design Criteria (PDC), including remedial work, should correct watershed problems from the past and allow stream health to improve over time.

This alternative would affect connected disturbed areas (CDA) as follows: 0 percent increase for the Headwaters Rio de Los Pinos, 8 percent for the Toltec Creek – Rio de Los Pinos, and 0 percent for the Wolf Creek watersheds. None of the watersheds would exceed the recommended 10 percent increase in CDA; this alternative would avoid any increase in CDA in the 7th level watershed of concern. The CDA would occur on currently closed or decommissioned roads. These roads would be closed or decommissioned at the completion of the project, returning CDAs to existing conditions.

Table 3-13. Alternative 3 watershed disturbance acres and percentages.

	Headwater Rio de Los Pinos (130100050201)	Toltec Creek- Rio de Los Pinos (130100050203)	Wolf Creek (130201020203)	Seventh Level Watershed (13010005050101)
Total watershed area (acres)	16,356	32,770	18,006	1,066
Proposed disturbance area(acres)	993	631.14	168.54	0
Percent proposed disturbance area to watershed area	6.07	1.93	0.94	0
*Percent proposed road equivalent disturbance area to watershed area	0.607	0.193	0.094	0

* Total equivalent disturbance acreage (as related to road disturbance) within a timber harvest project is calculated as 10% of the total harvest unit area.

Summary of the direct, indirect, and cumulative effects of the proposed project disturbances on a watershed analysis scale are shown in table 3-14. No alternatives would change the chemical quality of water.

Table 3-14. Direct, indirect, cumulative effects checklist for watershed attributes..

	Alt 1	Alt. 2	Alt. 3
AQUATIC ECOSYSTEMS			
Physical: Sediment	No effect	Minor effect	Minor effect
Bed/bank stability	No effect	Minor effect	Minor effect
Flow regimes	No effect	Minor effect	Minor effect
Chemical: Temperature	No effect	Minor effect	Minor effect
Water Purity	No effect	Minor effect	Minor effect
Biological: Aquatic life	No effect	Minor effect	Minor effect
SPECIAL AREAS			
Riparian ecosystems	No effect	Minor effect	Minor effect
Wetlands	No effect	Minor effect	Minor effect
Floodplains	No effect	Minor effect	Minor effect
CUMULATIVE EFFECTS			
Aquatic ecosystems	Major effect*	Minor effect	Minor effect
Riparian ecosystems	Major effect*	Minor effect	Minor effect

* Major effect determination is based on the likelihood of a more intense and severe fire if one should occur.
Note: This checklist ensures that all required effects are analyzed, gives a snapshot of all effects, and identifies items to dismiss from rigorous analysis. Effects shown assume full implementation of protection measures.

Cumulative Effects

The major disturbances in the 6th level watersheds have included timber harvest and associated road building. A total of 8,061 acres have been harvested (or approved for harvest) from the three 6th level watersheds in the past (appendix C, table C-1). Most of these activities include commercial thinning, shelterwood preparatory cut, patch clearcut, stand clearcut, overstory removal cut, and salvage harvest. Other activities that have caused impacts include livestock grazing and recreational use, including Trujillo Meadows reservoir and campground.

Roads are causing minor localized impacts to stream health. Several closed/decommissioned roads in the upper part of the Headwaters Rio de Los Pinos watershed now have good vegetative cover and have minimal impact to stream health at road intersections. Re-opening these roads would increase the potential for sediment input at road intersections and would require careful adherence to Project Design Criteria requirements to protect water quality (i.e. NFSR 118.1A has been identified as a concern for fisheries).

Proposed activities under the Cumbres Vegetation Management Project include salvage harvests, fuel treatments, and public firewood areas. The total disturbance of these activities would be a maximum of 2,766 acres. New temporary and non-system roads would also be opened for the proposed project. Watershed impacts due to any future sales vary with management prescription and would be evaluated on a watershed scale when analyzed. Roads associated with these projects usually have the greatest potential to impact watershed health, but compliance with Forest Standards and Guidelines minimizes impacts.

Increases in CDA would occur under both action alternatives. Increases under the proposed alternative would exceed the 10 percent recommended limit for increase for the Headwaters of the Rio de Los Pinos. These increases would be a short term increase as closed roads would be reclosed and decommissioned roads would be decommissioned. In the short term this may increase sediment transport to streams. In the longer term (5 years), these roads would return to existing conditions and not have any higher rates of connectivity that they currently exhibit.

The accumulation of watershed disturbances from past activities is not a threat to watershed health. Cumulative effects from the action alternatives are expected to be minimal at the watershed scale because the project area comprises a very small percentage of the watersheds. The treatments proposed under the action alternatives would aid in reducing the potential of a future high severity fire event at the watershed scale in the long term. These management actions would be part of establishing a more stable and resilient ecological condition in the watershed, shifting towards multi-aged forested stands with a greater proportion of mature trees.

Cumulative watershed disturbances from timber harvest activities are not expected to cause serious impacts under any alternative. Disturbances associated with the action alternatives would not threaten watershed or stream health as long as Forest Plan standards and guidelines and PDC are followed.

Stream health in the 7th level sub-watershed of concern was found to be robust with little likelihood of change due to proposed activities. However, since disturbance levels at the 7th level sub-watershed are greater than concern levels (16 to 17 percent, depending on the alternative) and a high percentage of natural basal area loss has occurred, additional monitoring, including an established channel cross section that was evaluated in the past would also continue for the current Cumbres project.

Potential impacts to watershed resources and water quality would be minimized by implementation of Forest Plan standards and guidelines and PDC. All surface disturbances from logging operations would be adequately buffered to prevent any additional direct impacts to the water influence zone (WIZ), floodplains, wetlands, and riparian areas. Improving existing roads should reduce overall erosion and sedimentation. In general, cumulative effects from past, present, and reasonably foreseeable actions would be expected to be negligible.

3.10 Soils

Scope of Analysis

For soils, the treatment unit (i.e. boundary of harvest or burn unit) serves as the analysis area. Harvest or fuel treatment units or groups of units are therefore considered the activity area for which direct, indirect, and cumulative effects on soil productivity are analyzed. Temporary roads, skid roads, and landings within unit boundaries are included in the disturbance analysis. System roads are considered part of the Forest transportation system and are not considered for detrimental soil disturbance.

Soil productivity is a site-specific characteristic. Loss of soil productivity in a treatment unit alone does not lead to a loss in soil productivity in an adjacent stand or other areas across a watershed. The analysis areas for consideration of cumulative effects are the same as those evaluated for the existing condition and direct/indirect effects. Assessment of cumulative effects on soil productivity at scales larger than the specific treatment unit boundary (such as the watershed scale) misrepresents the effects of management activities by diluting the site-specific effects across a larger area.

Each sampled unit was defined as an individual proposed harvest unit and each unit was analyzed separately. Proposed harvest units were surveyed in the summer 2011 using the National Forest Soil Disturbance Monitoring Protocol (Page-Dumrose et al. 2009) method for measuring soil disturbance (establishing transects through units in a zig-zag manner to cover the majority of the unit). These paced transects were used to measure existing ground cover, coarse and fine woody debris, slope, soil disturbance and other related soils data (i.e. compaction) for the unit. Distance between collection points was determined by the size of the unit. Ocular estimates, photo interpretations, and traverses (walk through) were used to estimate and correlate units with transect data to those without transects.

Existing Conditions

The soils in this analysis area are primarily of volcanic origin. Basalt, andesite, and rhyolitic rocks formed from volcanic materials and can weather to form clays. Volcanic ash also has been a source of soil parent material, forming fine silt soils. The project area contains broad, rounded mountains, with valleys, canyons and ridges typical of the San Juan Range. This soils analysis focuses on how well the project maintains long-term soil productivity and meets Forest Plan Standards.

The majority of the forested area soils fall within the Soil Resource Inventory (SRI) unit 151. SRI unit 151 has moderate risk of erosion and high mass movement potential. The SRI unit under the suitable timber lands rating it states "unsuitable due to mass movement except in the Cumbres Pass area" (USDA Forest Service, 1996). The Mancos shale underlying the volcanic parent material of the soil makes this soil unit susceptible to mass movement; however on gentle slopes this potential is reduced. In the Cumbres Pass area, the average slope is low based on field surveys. Thirteen percent of the sites recorded had slopes of greater or equal to 30 percent with the remainder of sites ranging from 0 – 25 percent. These relatively gentle slopes have allowed for past and present activities to occur in this area with minimal hazard for mass movement.

Soil Conditions - Detrimental soil disturbance (DSD) is soil disturbance that reduces soil productivity through compaction, topsoil removal, or nutrient depletions. On average the DSD was 11 percent, with a range of 0 to 23 percent. Coarse woody debris was present on average in 53 percent of sample points with a range of 34 to 68 percent. Individual unit results are shown in appendix C, table C-3. Temporary roads, skid roads, and landings within unit boundaries are included in the disturbance analysis. System roads are considered part of the Forest transportation system and are not considered for detrimental soil disturbance.

Table 3-15 shows the amount of DSD present in proposed harvest units. The 12 to 15 percent range is the level where rehabilitation is required to prevent disturbance in excess of 15 percent. Areas greater than 15 percent are above forest plan guidelines and would require post-harvest rehabilitation to reduce compaction. Units 9 and 15 have had little to no previous harvest activities. The majority of units fall within the moderate category. Units 1, 2, 6, 7, 11, and 20 would require some rehabilitation following harvest activities to return DSD levels below 15 percent.

Table 3-15: Detrimental disturbance percentages for proposed harvest units.

DSD range	Category	Unit #'s	Acres
0 - 5%	Low	9, 15	188
6 - 11%	Moderate	3, 4, 5, 8, 10, 12, 13, 14, 16, 17, 18, 19, 21, 22	1537
12 - 15%	Mod to High	1, 2, 11	420
>15%	High	6, 7, 20	361

Soil compaction was the most affected indicator measured. Excessive soil compaction can alter soil functions such as soil porosity, soil nutrient cycling, and soil hydrology. Increased compaction can also lead to increased runoff and erosion which can affect streams by eroding stream banks with excess flows into and down streams as well as increased sedimentation.

Past logging activities, especially those undertaken in the 1960s and 1970s, have often left units with skid trails that are closer together than the current recommended distance. In addition, few if any, reclamation activities were completed after the sales. Past evidence of timber activities make it possible to re-use existing timber roads, skid trails, and landings which would minimize the need for additional impacts.

Direct and Indirect Effects

Alternative 1 – No Action

Under the no action alternative, no additional management activities would occur. The existing conditions of DSD, ranging from 0 to 23 percent would persist. No new disturbance would occur and over time there would be a recovery of current disturbed sites. Coarse and fine woody debris would increase over time as the beetle killed trees die and eventually fall. Public fire wood gathering and hazard tree removal would occur along open roads.

Nutrient cycling, biological and chemical processes would continue. This would continue to gradually improve current conditions and restore lost soil productivity. Previously used roads and skid trails would remain in current conditions.

Over time increased CWD (down and standing) could lead to an increased down fuel loading. This, in turn, could lead to a potential increased hazard of a severe wildfire, should a fire occur. A severe wildfire would remove soil cover, damage soil processes, and increase soil erosion, thereby increasing sedimentation to nearby streams and rivers. Depending on the amount of soil heating, wildfires can have serious short-term implications for watershed protection. Severe wildfires not only destroy vegetation, but also can detrimentally burn soils. Soils are considered detrimentally burned when most woody debris, litter, duff, and humus are consumed down to bare mineral soil. Detrimentally burned soils reduce soil productivity and may result in gully formation, shallow slumping and decreased microbial activity. Soil heating, and thus fire severity, increases over time as a result of fuel build up from dead trees falling to the ground.

Alternative 2 – Proposed Action

Direct effects are the most obvious and are directly related to timber harvest activities (i.e. compaction, soil displacement and disturbance) that occur primarily on skid trails, landings, or areas where machines turn and displace soil or organic matter. Indirect effects may include increase erosion due to loss of soil cover, reduction of nutrients or disruption of nutrient cycling, and hydrological consequences such as fine sediment from erosion entering streams. The most common indirect effects include accelerated erosion, reduced fertility and reduced vegetative growth. Limiting equipment operation to dry or frozen soil conditions, on packed snow, on lower percentage slopes, and on previously used trails and roads would help limit impact to soil resources.

The soils in the area are primarily skeletal (greater than or equal to 35 percent rock fragments) which can help limit compaction. By avoiding operating heavy equipment off-roads during wet soil conditions and re-using existing skid trails and temporary roads, additional compaction can be reduced and avoided.

As timber is removed from the stand many nutrients can also be removed. If nutrients are removed, those available for plant growth are also reduced over time, depleting the soil. Nutrient cycling depends on the return of nutrients from dead trees and plants to return to the soil to be used for plant growth. By leaving fine and CWD in the units and returning slash from limbs and tree tops back to the stand the soil, where needed, productivity can be maintained (Harvey et al. 1987 and Graham et al. 1994). In addition, woody debris helps stabilize soils and prevent erosion.

There is a hazard of increased erosion created when old non-system temporary roads, decommissioned roads, and new temporary roads are reconstructed or constructed. Erosion would be mitigated by use of Best Management Practices set forth in Project Design Criteria (PDC). In addition, there is the potential for improvement through better closing and rehabilitation of roads following harvest activities.

Ground-Based Harvesting - Ground-based logging equipment could include rubber-tired log skidders, tracked feller buncher, and tracked skidders. The equipment is used in coordination to harvest and then gather trees to the landing. Usually the trees are transported to the landing where tops and limbs are removed. Project Design Criteria (chapter 2) would require a certain percentage of limbs and tops to be returned to the plot to ensure soil productivity is protected. A high priority would be placed on reusing existing skid trails and roads, with consideration to other resource needs. This would reduce the amount of additional disturbance created. Careful planning of new skid trails, re-using existing skid trails, and post-harvest sub-soiling of skid trails and landings would maintain or return cutting units to the maximum 15 percent disturbance level specified in the Forest Plan.

Ground based harvesting leads to soil compaction and soil erosion. Skid trails are compacted and can become conduits which can accelerate erosion and thus increase sedimentation to streams. This loss of soil can be extreme; however with the proper placement and use of water bars and application of slash after use, erosion can be controlled and soil fertility protected. Water bars can effectively reduce erosion by controlling runoff, which reduces erosion and soil loss. Application of slash over skid trails helps protect against erosion, filters sediments to protect streams, and provides a nutrient source to help with vegetation establishment and growth. These measures are also required by PDC.

Landings - Landings create areas with considerable compaction and soil disturbance. They also have the potential to increase soil erosion and sedimentation. To protect resources, landings would be sub-soiled where prescribed, and properly maintained to prevent erosion during and after harvest activities.

Landings are the center of the harvest activities. As such they are the most compacted and nutrient deficient location associated with harvest activities. Traditionally, landings are slow to recover. Rehabilitation measures can reduce erosion, protect water resources and reduce recovery times.

Fuels Treatments - There are 171 acres of proposed fuels treatments under both alternatives. These fuels treatments are primarily chainsaw cutting of trees and brush adjacent to private property. Burning of the small slash piles is likely, but these would not be expected to create enough soil heating to damage soils. Burn plans would be followed to maintain soil cover standards. Erosion would be minimal to none in relation to these activities.

Reforestation - Reforestation is anticipated to be completed manually, which would not cause additional ground disturbance.

Road Maintenance – Existing open roads are already highly used and require periodic maintenance and do not affect the soils resource. Road maintenance would increase and help to better protect the system from erosion and sedimentation. Reconstruction and reconstruction of temporary roads poses a hazard for soil erosion and loss. Care needs to be taken to properly construct, re-open and protect roads against erosion. Since this alternative would require more road construction, it would pose a greater risk. These requirements are covered in the PDC (chapter 2). In addition, closure and rehabilitation would need to occur to help remain within the 15 percent disturbance level set forth in the forest plan.

Existing roads would benefit from increased maintenance that would reduce erosion by effectively maintaining needed water dispersal mechanisms designed to prevent erosion from road prisms. This would also be the case for system roads not open to the public. These roads would remain closed to the general public and benefit from the increased maintenance.

Coarse Woody Debris (CWD) - The Forest Plan specifies a minimum 10 to 15 tons per acre in a spruce-fir forest type. Mechanical equipment can damage and reduce the effectiveness of some CWD already in the unit. PDC (chapter 2), requires that the amount specified remain in the plot to protect soil and soil

productivity. Initially some functionality of existing CWD may be lost due to mechanical disturbance of existing downed logs. The increased of CWD from the project over time would benefit the long-term soil productivity.

Alternative 3 – Limited Action

Effects of Alternative 3 would be similar to Alternative 2 except there would less ground disturbance under since fewer acres would be proposed for harvest, thereby requiring fewer landings, skid trails, and temporary roads.

For units not proposed for harvest under this alternative, effects would be similar to alternative 1. Units 7 and 20, with high levels of DSD, and units 1 and 11, with moderate to high levels of DSD would recover slowly over time; soil productivity would continue to improve.

Summary of effects for action alternatives - In general, both alternatives would likely meet Forest Plan standards and guidelines after rehabilitation measures are completed. PDC and best management practices (BMPs) would minimize new soil disturbance activities, such as skid trails and landing placement. Landings and skid trails are the main concern to soil disturbance. Past disturbances can have lasting effects on soil productivity, by implementing rehabilitation measures following salvage harvest, compaction resulting from past actions could be addressed, increasing the rate of improvement in overall soil quality and productivity.

Cumulative Effects

Cumulative effects are based on the number and types of management activities occurring within a unit over time. These effects are measured by how they affect soil productivity and effects are measured by determining the spatial extent of disturbance within a unit.

Past timber harvest activities have resulted in soil various degrees of detrimental soil disturbance. Other off-road activities that may affect soil productivity in the area are limited to very localized high-use areas popular with dispersed campers, some livestock trails, or firewood gathering within 300 feet of open roads. No other projects are reasonably foreseeable in the analysis area. Any cumulative effects that may occur would be over a very limited spatial extent and be relatively minor.

3.11 Air Quality

Scope of Analysis

This section describes the effects to air quality in the vicinity of the Cumbres project analysis area including nearby private land and the South San Juan Wilderness Area, a Class I Airshed. The nearest town is the Village of Chama, New Mexico, which is about 12 miles south.

Current land ownership patterns, wilderness designations, relatively low population, and lack of industrial development have minimized the sources of sustained air pollutants. Pulses of emissions that do occur are generally small, localized, and short-lived and therefore seldom overlap in time and space.

The Clean Air Act, passed in 1970 and amended in 1977 and 1990, requires the Environmental Protection Agency (EPA) to set standards for air pollutants to protect the public health and welfare. The standards, known as National Ambient Air Quality Standards, limit the amount of these pollutants that can be present in the atmosphere. The EPA has set standards for six common pollutants known as “criteria” air pollutants—ozone (O_3), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), and carbon monoxide (CO). There are standards for two categories of particulate matter—one for

suspended particles less than 10 micrometers in diameter (PM_{10}) and one for fine particles less than 2.5 micrometers in diameter ($PM_{2.5}$). Primary standards are designed to protect public health, while secondary standards are designed to protect public welfare. These standards can be found at: http://www.epa.gov/air/criteria.html

Unlike most other criteria pollutants, ozone is not emitted to the atmosphere directly; it is formed when nitrogen oxides and volatile organic compounds react in the presence of sunlight. In general, ozone concentrations in the lower atmosphere are highest during warmer months and lower in the cooler months. In some parts of the western U.S., high winter-time ozone concentrations have been monitored. The project area is not in an airshed with monitored high winter-time ozone concentrations. The chemical reactions that form ozone are complicated and nonlinear, making it difficult to predict ozone concentrations that will result from increasing nitrogen oxides and volatile organic compounds in the atmosphere; effects depend on the ratio of the two precursors already present. Ozone formation is also highly dependent on meteorological conditions, including temperature, wind speed, and solar radiation. Ozone in the lower atmosphere is harmful to human health and vegetation. Some fine particulates ($PM_{2.5}$), particularly ammonium sulfate and ammonium nitrate particles, can also be formed in the atmosphere from the interaction of either SO_2 or nitrogen oxides or ammonium. These types of $PM_{2.5}$ particles are referred to as secondary particulates, while particles emitted directly from a source are referred to as primary particulates.

Fine particulate matter ($PM_{2.5}$) is chiefly comprised of five mass types: organic mass, elemental carbon (also known as soot or black carbon), ammonium sulfates, ammonium nitrates, and crustal materials (i.e., soil). Primary fine particulate emissions result from combustion processes (including fossil fuel combustion and biomass combustion that occurs in wildfires) and include black carbon. In general, however, black carbon and crustal materials comprise a relatively small proportion of the fine particulate mass suspended in the atmosphere.

Visibility- Visibility is a measure of how clearly distant objects can be seen. Clear visibility is one of the most noticeable and highly valued attributes of any landscape for wilderness visitors. Impairment to visibility is commonly called *haze*, which results when particles in the air scatter and absorb light. As airborne pollutants increase, more absorption and scattering of light occurs, thereby reducing the clarity and color of distant objects. *Uniform haze* is well-mixed pollution from one or more sources that obscures visibility uniformly. *Layered haze* occurs when pollutants appear as a layer due to poor mixing. A *plume* is a continuous column from a single source. Air pollution likely impairs visibility to some degree on all Federal lands. The visual range in the West averages between 60 and 90 miles, or about one-half of the visual range under natural conditions.

Visibility is a measure of not only how far one can see, but how well one can see important characteristics of the landscape such as form, color, geologic features, and texture. Visibility is limited by the presence of particles and gasses in the atmosphere that scatter and absorb light. In the Clean Air Act, Congress established a national goal of remedying any existing, and preventing any future, impairment to visibility caused by manmade pollution in mandatory federal Class I areas (42 USC § 7491), including the South San Juan Wilderness Area. To aid the implementation of Clean Air Act and EPA legislation, the Interagency Monitoring of Protected Visual Environments (IMPROVE) program was implemented in 1985 to launched an extensive long term monitoring program to establish the current visibility conditions, track changes in visibility, and determine mechanisms for visibility impairment (http://vista.cira.colostate.edu/improve).

Various particulates contribute to haze and visibility impairment, as shown in table 3-16. Some types of particles such as sulfates are more efficient at scattering light, particularly during humid conditions. Fine particulates ($PM_{2.5}$) that are prevalent in smoke are more efficient at scattering and absorbing light and impairing visibility than coarse particulates (PM_{10}). Smoke can cause short-term visibility impacts by

obscuring the form, contrast detail, and color of near and distant features. It poses a safety hazard when it obscures visibility on land, water, or aerial transportation routes. Smoke can also cause public nuisance and complaints about loss of visibility, odor, and soiling from ash fall-out at relatively low pollutant concentrations.

In order to meet the goal set by Congress in the Clean Air Act of remedying existing manmade visibility impairment in mandatory federal Class I areas, the EPA promulgated the Regional Haze Rule in 1999. This rule requires states to develop plans to reduce manmade pollution in Class I areas.

Table 3-16. Major contributors to visibility impairment.

Particulate	Sources and Comments
Sulfate	Particles form in the air from sulfur dioxide gas, released primarily from industrial sources such as coal-burning power plants, smelters, and oil refineries. Sulfates are the largest contributor to haze in the eastern U.S. In humid environments, sulfate particles grow rapidly to a size that is very efficient at scattering light.
Nitrate	Particles form in the air from nitrogen oxide gas, released from virtually all combustion sources (esp. cars, trucks, and motors like those in lawn mowers, and boats, power plants, oil and gas production, and other industrial sources). Like sulfates, nitrates scatter more light in humid environments.
Organic Carbon	Particles emitted into the air and also form as a reaction of various gaseous hydrocarbons. Major sources include vehicle exhaust, vehicle refueling and solvent evaporation. Hydrocarbon emissions from forests and wildland fire smoke are additional sources. Fire emissions also include primary organic particles in the form of uncombusted material.
Elemental Carbon	Particles emitted directly into the air from virtually all combustion activities and are especially prevalent in diesel exhaust and smoke from the burning of wood and wastes. Elemental carbon particles like soot are smaller than most other particles and absorb rather than scatter light. The brown clouds often seen in winter over urban areas and some mountain valley towns can be largely attributed to elemental carbon.
Crustal Material	Particles enter air from dirt roads, fields, and other open spaces as a result of wind, traffic, and other surface disturbing activities.

Existing Conditions

Current conditions of air quality in Colorado are detailed in the Colorado Air Quality Control Commission: Report to the Public 2012-2013 (http://www.colorado.gov/cs/Satellite/CDPHE-AQCC/CBON/1251592949477. The project area is located in Colorado's Central Mountains Air Quality Region which includes many of the mountains and mountain valley areas of the state. Skiing, tourism, ranching, mining, and correctional facilities are the primary industries in this region. All of the area complies with federal air quality standards (Colorado Dept. of Public Health 2011).

Air quality in the area is generally good. Areas that meet federal ambient air quality standards are classified as being in attainment, while areas not meeting standards are classified as being in nonattainment. On April 30, 2012, the EPA finalized its ozone nonattainment designations with respect to the 2008 ozone standard[7] EPA identified only one nonattainment area in the Denver-Boulder-Greeley-Fort Collins metropolitan areas located along the Front Range approximately 150 miles to the northeast of the project area. EPA has not identified any current nonattainment areas in Colorado for any of the other criteria pollutants.

[7] (http://www.epa.gov/airquality/ozonepollution/designations/2008standards/final/region8f.htm).

Colorado maintains a network of monitors that track compliance with ambient air quality standards. Most of the monitors are located in the eastern half of the state, particularly along the more urban Front Range. Southwestern Colorado, by comparison, is relatively sparsely populated, and there are no monitors in the immediate vicinity of the project area. There are, however, monitors in some areas of western Colorado. Table 3-17 shows the maximum monitored values by county for selected counties near the Forest for the period 2009-2011. Not every county in the area has monitoring, and counties that do have monitors do not necessarily have monitoring for all criteria pollutants. No monitoring data were available for this period for SO_2 or lead concentrations for the selected counties. While these monitors cannot provide information regarding air quality in the immediate vicinity of the project area, they do give some insight into regional air quality conditions.

Table 3-17. Monitored criterion pollutants in nearby counties, 2009 to 2011.

County	Year	CO 2nd Max 1-hr (ppm)	CO 2nd Max 8-hr (ppm)	NO_2 98th Percentile 1-hr (ppb)	Ozone 2nd Max 1-hr (ppm)	Ozone 4th Max 8-hr (ppm)	$PM_{2.5}$ 98th Percentile 24-hr ($\mu g/m^3$)	$PM_{2.5}$ Weighted Mean 24-hr ($\mu g/m^3$)	PM_{10} 2nd Max 24-hr ($\mu g/m^3$)	PM_{10} Mean 24-hr ($\mu g/m^3$)
Archuleta	2009								78	23
	2010								65	21
	2011								81	21
Gunnison	2009								86	27
	2010				0.07	0.06			92	24
	2011				0.07	0.064			74	24
La Plata	2009	1.4	0.9	47	0.08	0.071	12	4.4	40	20
	2010	1.2	0.7	39	0.08	0.074	11	4.3	88	21
	2011	1.3	0.7	38	0.08	**0.077**	12	4.5	50	18
San Miguel	2009								72	18
	2010				0.06	0.059			52	15
	2011				0.08	0.069			61	16

The table demonstrates that air quality in the vicinity of the project area is in compliance with the National Ambient Air Quality Standards. Only one exceedance of a standard is noted in the table, for ozone monitored in La Plata County in 2011. The monitor that recorded the exceedance was the Shamrock Mine monitor, located near Crawford, CO. The annual 4th-highest 8-hour ozone average for that year was 0.077 ppm. Since a violation of the standard only occurs when the three-year average of the annual 4th-highest daily maximum 8-hour is over 0.075 ppm, an individual exceedance does not necessarily indicate a violation of the standard.

Visibility is tracked using data from the IMPROVE monitoring system. There are no IMPROVE monitoring sites in or near the South San Juan Wilderness area. The two IMPROVE monitoring stations in southern Colorado are located on Engineer Mountain on the San Juan National Forest (over 80 miles northwest of the project area) and in the Great Sand Dunes National Park (over 72 miles northeast of the project area). There is also an IMPROVE monitoring site located in northern New Mexico in the Wheeler Peak Wilderness area, but that site is also over 60 miles southeast of the area.

Direct and Indirect Effects

Alternative 1 – No Action

No logging operations or pile burning would occur, so no additional emissions would occur.

If a large wildfire would occur, regional air quality and visibility would be impacted during the life of the fire due to large releases of emissions associated with wood and vegetation combustion (see additional discussion under alternative 2). These large emissions would last during the life of the fire (up to several weeks) and have widespread effects.

Alternative 2 – Proposed Action

Proposed project activities in the action alternatives that could directly affect air quality would include the combustion of fuel from equipment use in cutting, transporting, and hauling logs, burning slash piles at landings following harvest completion, and, if used, burning handpiles as part of WUI fuel reduction treatments.

Some road re-construction/maintenance would occur under both of the action alternatives. In general, this would result in emissions of fine particles (dust) from the disturbance to the ground surface and processing of road building materials, if needed, such as crushed rock, sand, and gravel, as well as volatile organic compounds, soot, nitrogen oxides, sulfur dioxide, particulates, carbon dioxide, and carbon monoxide from vehicle and construction equipment engines. Once road work is complete, vehicles travelling along the roads would emit, through their exhaust systems, volatile organic compounds, nitrogen oxides, sulfur dioxide, particulates, carbon dioxide, and carbon monoxide. Travel by vehicles along unpaved roads would result in additional emissions of fine particles from the surface of these roads.

Vehicle emissions from harvest operations would occur. Impacts from emissions would be short-term and localized, but would occur on an intermittent basis for several years. Vehicles used in harvesting operations and gas and diesel powered equipment used to cut and remove trees would result in emissions typically found in gas and diesel exhaust, including sulfur dioxide, particulates, volatile organic compounds, carbon dioxide, and nitrogen oxides. Depending on the season of logging (winter vs. summer), some amount of dust could be generated by harvest activities which could be more visible than vehicle emissions When logging during the dry periods, Project Design Criteria (PDC) would require dust abatement on FSRs 118 and 118.1C, which are the major recreation user access roads in the project area. Dust abatement would reduce the dust from all traffic during the period of use for this road.

The two action alternatives identify winter pile burning as a likely way to dispose of slash generated by both the WUI fuel treatments and the large slash piles at landing areas. The WUI fuel treatments could result in approximately 9 acres of handpiles (maximum size 8 ft. by 8 ft.) scattered across about 171 acres along two blocks of private land. Adjacent private homes are generally occupied only in the summer months, so the minor amounts of smoke generated would be unlikely to impact these residences. It is estimated that logging activities would generate between 15 and 22 larger piles at landings, depending on the alternative. Burning of landing slash piles would likely occur at a rate of a few per season over several years, depending on the rate of harvest operations. The limited scale of winter burning operations would be unlikely to impact nearby summer residences or the Village of Chama.

Pile burning would result in emissions typically associated with wood combustion, particularly volatile organic compounds, nitrogen oxides, soot, particulates, carbon dioxide, and carbon monoxide. Fires could also emit hazardous air pollutants, such as polynuclear aromatic hydrocarbons and aldehydes (such as formaldehyde). Since prescribed fires and slash burning are conducted under controlled conditions, are less intense than wildfires, and are much smaller in size, it can be reasonably expected that the emissions

resulting from these fires would be considerably lower than those from an uncontrolled wildfire. All pile burning operations would also require smoke permits issued by the Colorado Air Pollution Control Division (CAPCD). Prescribed burn permits include specific parameters that must be met to limit short term air quality impacts from smoke. Prescribed burns also require burn plans that consider smoke dispersal and impacts to local residences and visitors to the area to ensure that adverse effects are minimized.

Alternative 3 – Limited Action

Qualitatively, Alternative 3 would generate less vehicle emissions and dust, since fewer acres would be harvested and fewer slash piles would be burned, but neither alternative would be expected to have a measurable impact on local air quality.

Cumulative Effects

Emissions generated by implementing an action alternative would contribute somewhat to local pollution, but all affects would be short-term and limited. Due to the limited scale of potential logging operations and slash pile burning, the extent of impacts is expected to be quite small. Once project activities are completed in a particular area, any additional dust or smoke impacts would cease and have no further overlap in time or space with other pollution sources. As a result, proposed activities within the Cumbres project area are not expected to contribute to any violation of National Ambient Air Quality standards or to contribute measurably to any increase in visibility impairment at nearby Class I areas.

All alternatives, therefore, would comply with the Clean Air Act. This conclusion is additionally supported by the Forest Plan FEIS (USDA Forest Service 1996a), pages 3-151 through 3-154 that air quality on the Forest is good for all air pollutants and all Forest Plan approved activities would meet National Ambient Air Quality Standards.

3.12 Fire and Fuels

Scope of Analysis

This analysis covers an area of approximately 3,546 acres in the Neff Mountain and Trujillo Meadows area west of Cumbres Pass.

The processes used to conduct the technical analysis were the computer applications of the Forest Vegetation Simulator (FVS) with the Fire and Fuels Extension, Fuels Management Analyst Plus Ver. 3 (FMAPlus) and BehavePlus 5.0.

FVS models stand and understory attributes from stand inventories and then simulates growth over time. Disturbances and management actions can also be simulated decades into the future. In this analysis FVS was utilized to calculate snag fall and surface fuel accumulations over a 50 year time period. This simulated surface fuel loading was then compared to fuel loadings in the Photo Series Editor in FMAPlus to determine which fuel model would best represent these stands at the 1, 20, and 50 year time steps. BehavePlus was then utilized to model fire behavior and estimate rates of spread and flame lengths.

The stand conditions used in FVS were modeled every 10 years out to the year 2062. A wildfire was simulated in 2012, 2032 and 2062 in separate simulations to compare potential fire behavior as stand conditions changed.

Existing Conditions

Fire Analysis - The Cumbres project area would be generally categorized as Fire Regime V or infrequent fire occurrence (200+ years) and stand replacement in nature. The area is dominated by Engelmann spruce and subalpine fir on the higher slopes, ridges and valleys. Aspen is a minor component in the project area. Climate and weather conditions play a greater role in large fire development than fuel loading in this type of fire regime.

Fires in high elevation forests of the southern Rocky Mountains are infrequent and usually small, due to snowmelt and the frequent summer rain showers that generally keep these areas too wet to burn throughout most of the growing season. However, in rare dry years or under extended drought conditions, sufficient drying of the fuels may allow for large fires to burn across extensive portions of the landscape in severe, stand-replacement fires. These large stand replacing events lead to patches of forest types on the landscape that are uniform in their succession and stand characteristics (Romme et.al. 2009).

When these spruce/fir stands burn as stand replacing fires, fire behavior is often of very high intensity[8] with flame lengths reaching two to three times the height of the existing canopy, exhibiting rapid rates of spread, and producing extensive fire brand/ember lofting ahead of the main fire. Large, down woody debris is often completely consumed and extensive soil heating can occur, which can affect many physical and chemical soil properties. Fire severity[9] and/or soil burn severity can be extensive in a stand replacing fire and determines how soon pioneer species recover within the area. In severely burned areas, soils may lose the ability to absorb moisture and exhibit water repellency for several years following the event.

Past fire suppression activities within the analysis area have been limited to small single tree fires or fires that seldom grew beyond 10-20 acres. This area has not seen extensive, landscape scale fires since the late 1800s/early 1900s. Much of the analysis area has been logged in the past and the removal of much of the over-story has affected the subsequent stand development.

Fuels Analysis - Intense scientific interest in bark beetle-fire interactions is relatively recent and ongoing. It is clear that beetle infestations have a direct effect on wildfire potential, and that the degree of influence can be categorized by the phase of the infestation. Bark beetle mortality modifies the canopy fuels, surface fuels (grasses, forbs, shrubs, downed-woody material) and ground fuels (dead litter and humus). Localized weather conditions such as increased sun, wind, and rain or snow are also modified in proportion to the number of trees killed. These changes are directly linked to changes in the forest water balance which are known to affect fuel moisture relationships, and therefore fire behavior (USDA Forest Service 2011).

Current understanding of effects of bark beetles on fire behavior: Basic fire science principles suggest that opening the forest should lead to drier surface fuels, more sunshine, and more wind which would favor increased ignitions and early fire spread resulting in more fires requiring management. Past experience is largely anecdotal, but decades of firefighter wisdom suggest that any fires will be more intense for an indeterminate amount of time following attack.

- Following attack, forest composition and structure are fundamentally altered. Fire behavior can be expected to decline somewhat in the post attack phase and not return to pre-fire conditions. Conditions for surface fire spread are improved, whereas conditions for crown fire spread are

[8] **Fire intensity** - Energy output from the flaming front of the fire, does not take into account the smoldering combustion post fire frontal passage; closely correlated to flame length.

[9] **Fire severity**- Aboveground and belowground organic matter consumed by the fire. Soil burn severity- Amount of belowground organic matter consumed by the fire, a factor determined by soil temperature and duration of heating.

reduced. However, snags present unique fire behavior problems, principally as a source for, and recipient of, embers which start new fires ahead of the main fire.

- Snags constitute a major safety hazard for fire fighters. Safety concerns will reduce fire fighter effectiveness leading to larger fires.
- Heavy downed logs slow fireline construction. The increased resistance to control implies fires will either grow larger or require more suppression resources.
- Heavy downed logs are associated with extended burning, greater soil heating, sustained smoke production and extended fire mop-up, particularly in warmer-dryer forests.

The landscape level West Fork and Papoose fires that burned just less than 88,000 acres in similar stand conditions of spruce beetle mortality on the Divide Ranger District on the Forest during the summer of 2013 generally exhibited the type of fire behavior described above. Fire behavior reports completed during the fire indicated that the dry needle cast and dead spruce, combined with minimal relative humidity recovery, lead to quick transitions between surface and crown fires. The large numbers of snags were considered safety hazards to firefighters and contributed to the limited options for fire suppression strategies under the dry, windy weather conditions. Extreme long range spotting up to 3 miles ahead of the main fire was observed under plume-dominated fire behavior. Portions of the burn area with high surface fuel loadings experienced severe soil heating impacts, while other areas had minimal soil impacts due to the high winds. Fire behavior analysts re-emphasized that current crown fire prediction models are not valid in recently beetle killed forests.

Based on stand exam data and Forest Vegetation Simulation modeling, surface fuel loadings varied extensively across the analysis area from stands with 20 tons/acre at the low end to stands with greater than 70 tons/acre at the high end. Due to the extensive spruce beetle mortality, surface fuel loads are expected to increase over time. Snag fall-down rates for spruce beetle mortality have not been well documented, but Schmid & Hinds (1974) estimated an annual snag fall rate of 1.5 percent in spruce beetle killed Engelmann spruce. Meilke (1950) found that 84 percent of beetle killed spruce snags on the Dixie National Forest, in Utah were still standing after 25 years. A somewhat higher percentage of trees had dropped out of the smaller diameter classes than in the larger ones.

Direct and Indirect Effects

Alternative 1 – No Action

The short-term effects of the spruce beetle mortality will be an increased risk of crown fire initiation and spread while the dead trees retain the red or gray needles. This risk drops dramatically once the needles have fallen, usually within 1 to 3 years following infestation. Once the needles have fallen, there would be increased sunlight available to the forest floor which should lead to an increase in herbaceous plant growth. The increase in available fine fuel, plus the opening of the canopy, would allow for increased winds at ground level resulting in potentially higher rates of spread for surface fires. So while the risk of crown fires decreases, the rate of spread for surface fires would increase. Over time, as regeneration fills in, the potential for higher rates of spread may decrease.

Over the long term, as more of the dead trees fall, the surface fuel loading of large diameter material would increase. Due to the slow decay of the large diameter fuels in this environment, this material would continue to accumulate which would result in higher intensity fires of longer duration, if the area burns. These high intensity burns would increase soil heating to a deeper depth, detrimentally impacting soil micro-organisms and nutrient cycling.

As shown in table 3-18, the modeled projections for the no action alternative would produce the following tons per acre (T/A) of surface fuel loadings for 2013, 2033, and 2063. The modeled fire behavior under the no action alternative indicates average flame lengths of 11to 12 feet in length, rates of spread of 26-29 chains[10] per hour and heat per unit area of 2150-2550 BTUs per square foot under 90th percentile weather conditions across the majority of the project area throughout the 50 year timeframe.

Table 3-18. Modeled surface fuel loading, Alternative 1.

Year	Average > 3" Diameter Surface Fuel Loading (tons/acre)
2012	32 T/A
2032	43 T/A
2062	42 T/A

Alternative 2 – Proposed Action

Under the proposed action alternative harvest activity would remove approximate 32 tons per acre of the dead standing trees which would no longer contribute to the surface fuel loading over time. The modeled surface fuel loads for Alternative 2 in 2032 and 2062 are also shown in the second column of the table below. The difference between Alternative 2 and Alternative 1 in 2032 and 2062 are shown in table 3-19. The results of the harvest activity would be a lower surface fuel loading over time.

Table 3-19. Modeled changes in surface fuel loading for action alternatives.

Year	Average > 3" Diameter Surface Fuel Loading in Alternative 2	Difference between Alternative 2 and Alternative 1 in Average >3" Fuel
2032	30 T/A	13 T/A less
2062	26 T/A	15 T/A less

The modeled fire behavior under the proposed action alternative indicates average flame lengths of 9 feet in length, a rate of spread of 22 chains per hour and heat per unit area of 1718 BTUs per square foot under 90th percentile weather conditions across the project area following harvest in 2012. This modeled fire behavior is somewhat similar to the no action alternative. However, in 2032 the flame lengths decreased to 4 feet in length, the rate of spread decreased to 20 chains per hour (1,320 feet hour) and heat per unit area decreased dramatically to 434 BTUs per square foot. In 2062 the flame lengths were projected to be 6 feet, the rate of spread increased to 34 chains per hour due to wind speeds that were increased by opening up the stands, and the heat per unit area was projected to be 467 BTUs per square foot.

Overall, harvested units show a decrease in greater than 3 inch diameter fuels, flame lengths, and heat per unit area when compared to the no action alternative. In units that currently have an aspen component, the opening of the stand to increased sunlight and the disturbance of the logging activity could increase aspen sprouting and regeneration. Depending on the amount of aspen regeneration, fire behavior could be moderated in these areas.

The alternative 2 has the greatest effect in reducing potential flame lengths which is correlates to decreased potential fire intensity and soil heating. In some of the units the potential rate of spread increases or stays the same due to the more open nature of the stands which would allow for increased wind speeds at the surface. The removal of small diameter ladder fuels and thinning from below along the private property boundary would improve the defensibility of the private property and reduce the potential for crown fire initiation and spread in those areas. The proposed thinning on 171 acres adjacent to private property is

[10] One chain equals 66 feet.

expected to generate an average of 40 slash piles per acre, each covering approximated 64 sq. ft. (8' x'8' footprint). The area impacted by winter slash pile burning would be approximately 2560 square feet/acre or approximately 9 acres within the analysis area. Because these piles are very small and the ground is typically frozen when the slash is burned, there would be very little impact to the soil from these pile burns.

The proposed alternative would reduce large diameter surface fuel accumulation in the harvested units over time by the removal of the dead standing trees. As the residual live trees and subsequent regeneration mature, the fuel loading and potential fire behavior would continue to change. Spruce/fir stands at this elevation do not burn often due to moister weather conditions during most fire seasons. Long term drying conditions (drought) and favorable short term weather conditions (low RHs, higher temps, and increased winds) are usually required for these stands to burn. However if these conditions are present, the proposed alternative could reduce potential for high intensity burns of long duration that could detrimentally affect soil micro-organisms and nutrient cycling in areas that have been harvested

Alternative 3 – Limited Action

Under the limited action alternative the modeled large diameter fuel reductions and fire behavior would be the same as the proposed alternative with a reduction in acreage harvested and no treatment done in units 1, 2, 3, 9, 15, 16, 18, 19, and 20. Units not harvested would have fire behavior similar to Alternative 1 with higher fuel loadings, and increased flame lengths and rates of spread. The effects of thinning along the private property would remain the same.

Cumulative Effects

Since no further vegetation management activities are planned in the project area, there would be no cumulative effects to fire or fuels management within the analysis area.

Social Resources

This section includes a summary of potential effects on social resources. Complete reports are located in the project file.

3.13 Social-Economics

Scope of Analysis

The social effects analysis primarily focuses on Conejos County, Colorado and to a certain extent on Rio Arriba County, New Mexico. The surrounding communities include Antonito and La Jara, Colorado as well as Chama, New Mexico, due to its proximity to the analysis area.

Existing Conditions

Most of the early settlers in Conejos County used the surrounding lands for logging, mining, sheep, and cattle grazing. Much of the population lived in rural areas where the National Forest lands were important for gathering firewood for heating and cooking, collecting medicinal plants such as *Osha*, gathering food such as mushrooms, and for hunting, trapping, and fishing. A large portion of the population in Conejos County has historically been dominated by individuals of Hispanic origin, with many of the residents being descendants of the original Spanish settlers. The influence of the Spanish culture is evident in the local architecture and in the names of towns and geographic features of Conejos County, Colorado and Rio Arriba County, New Mexico.

The National Forest lands continue to be an important source of firewood and an important source of special forest products for the local population. Census data indicate that about 28.8 and 18.1 percent of the

households in Conejos and Rio Arriba counties, respectively, use wood as a heat source. Livestock grazing has also remained an important component of the local economy. Many of the local ranchers graze cattle and sheep on Forest Service allotments in Conejos County.

The local economy in Conejos County has changed over time as recreation has become more important. This is particularly true in areas near the project area with the Cumbres & Toltec Scenic Railroad, the Caminos de los Antiguos Scenic Byway, the Continental Divide National Scenic Trail, and the South San Juan Wilderness Area located nearby. There are many local outfitter guide services, cabins, second homes, campgrounds, and businesses catering to area visitors. The area offers excellent opportunities for site seeing, hiking, hunting, fishing, camping, horseback riding, snowmobiling, cross country skiing, snow shoeing and wildlife viewing. All of the recreational opportunities and services provided by local businesses have made recreation a very important component of the local economy. National Forest lands have also continued to be utilized for their hunting and fishing resources. These resource users contribute to local economy during the summer and fall months and support the Colorado Parks and Wildlife (CPW) through license fees.

Timber harvesting and other forest management activities have had mixed benefits to the local population; some timber sales have been purchased by local mills that generally utilize local contractors for logging operations, other sales have been purchased by mills from outside the local area, though sometimes these mills contract with local contractors. These types of activities do contribute to the diversity of employment opportunities in the area. National Forest lands continue to be an important source of sawtimber for the timber industry in Colorado.

The economic analysis focuses on the financial efficiency associated with commercial harvest treatments. It does not determine if the sales are above or below cost, compares the financial efficiency of each alternative. This financial efficiency analysis does not incorporate monetary values for all known market and non-market benefits and costs. Discussions specific to the timber industry focus primarily on the State of Colorado though nearby Chama, New Mexico also has some wood processing facilities.

Cost efficiency is a measure of how well inputs (activities) are used in a production process to produce a fixed set of outputs. It is only a partial measure because not all benefits and costs to society can be quantified. Revenues from sawtimber have been assigned dollar values based on current markets and are quantifiable. Other resources such as watershed health, riparian health, wildlife abundance and diversity, long-term habitat improvement, social benefits, and scenic resources cannot easily be assigned dollar values. This financial efficiency analysis does not consider ecosystem services or non-market goods that are not required at the project level by the NFMA. Ecosystem services and non-market goods are addressed in the Forest Plan FEIS (FEIS 3-445 through 3-469).

Direct and Indirect Effects

One financial analysis with three alternatives was run for the project. Table 3-20 summarizes the cost-benefit and Present Net Value results from Quick-Silver.

Table 3-20. Quick-Silver financial efficiency analysis by alternative.

Alternative	PV Benefits	PV- Costs	Benefit: Cost ratio	Net Present Value	Approx. Vol. (CCF) Harvested	Fuel Reduction Acres
Alternative 1	$0	$250,000	0.00	-$250,000	0	0
Alternative 2	$402,779	$956,490	0.42	-$553,712	44,747	171
Alternative 3	$235,810	$646,735	0.36	-$410,924	32,083	171

Alternative 1 – No Action

The no action alternative would have various effects on the local populations because the areas impacted by spruce beetle would not be treated. If left untreated, over time, these may become less accessible due to the number of downed trees, and could be unsafe to enter as trees began to fall.

A beneficial outcome of the no action alternative could be the abundance of firewood that could be made available to the public, though many of the acres are not adjacent to open roads, so dead trees would not be accessible without additional actions. In addition, the no action alternative would minimize any short-term social conflicts between logging operations and recreational users.

Financially, Alternative 1 would not generate revenues through the sale of commercial forest products. The cost of the environmental analysis is not offset by revenues generated through the sale of timber. The no action alternative would have a negative impact on the local timber industry. The benefit-to-cost ratio for this alternative is zero. This alternative creates a negative cash flow for the Forest Service and does not provide means for site reforestation in suitable timber lands that are infested with spruce beetles and lack advanced regeneration, nor does it assist with road maintenance or other needed road improvements.

Alternative 2 – Proposed Action

Alternatives 2 and 3 would have similar effects. Under these alternatives, approximately 30 to 44.7 CCF of forest products would be made available to the forest industry. Providing this volume would allow local mills to effectively compete for resources because of lower mobilization and operational costs. Other beneficial impacts would include the increased public safety and usability of the area after harvest is completed compared to the no action alternative. Firewood would remain available under these alternatives and fuel reduction treatments would reduce the potential for property damage caused by wildfires. Removal of hazard trees would help protect infrastructure from damage and reduce the time and costs to protect these features.

Each of the action alternatives creates potential for conflict between harvest activities and other forest users. Some forest visitors may choose to use different areas, in the short-term, which could negatively impact local businesses. In addition, the Forest Plan states that Forest visitors can expect to see managed stands of trees in a natural or near-natural forest setting. Stands would have evidence of management, including tree stumps, slash, skid trails, and soil disturbance. These action alternatives, in combination with changes that are occurring naturally on the landscape, may shift social uses that take place in the project area, bring new users into the area, or direct current users to different locations.

Alternative 2 would generate a benefit-to-cost ratio of 0.42 with the proposed harvest and artificial regeneration under this alternative, since the benefit-to-cost is less than 1.0; this alternative is financially below cost to the Forest Service. The net present value of this alternative is -$553,712. The present value benefit of the forest products being offered under this alternative is $402,779; these benefits include only

sawtimber volume sold and do not include personal use or commercial firewood, as this project is not expected to create a net increase in the amount of firewood available or sold. The present value cost associated with implementing this alternative is $956,490; these costs include timber sale preparation, road work needed to access the sale areas, timber sale administration, slash disposal, and reforestation. Under this alternative, approximately 44,747 CCF of sawtimber could be offered.

Alternative 2 has the largest benefit-to-cost ratio, but the smallest net present value of the alternatives analyzed. Though this alternative is financially below cost, the economic benefit of supplying timber to industry not only supports the timber industry, but also supports secondary businesses and local communities, and helps the Forest meet Forestwide objectives 7.1 and 8.2 and fulfill the intent of the Forest Plan ROD.

Alternative 3 – Limited Action

Alternative 3 generates a benefit-to-cost ratio of 0.36, the smallest ratio of the two action alternatives, but has the largest (though still negative) net present value of the action alternatives. The present value benefit of the forest products offered under this alternative is $235,810, and the present value cost associated with offering this product is $646,735; these costs include timber sale preparation, road work needed to access the sale areas, timber sale administration, slash disposal, and reforestation. Under this alternative, approximately 32,083 CCF of sawtimber could be offered. As with Alternative 2, this alternative is financially below cost for the Forest Service, but supports local communities by making timber available to the forest products industry. In doing so, this alternative helps the Forest meet Forestwide objectives 7.1 and 8.2 and fulfills the intent of the Forest Plan ROD in regards to timber outputs and economic diversity.

Cumulative Effects

This analysis area is adjacent to other active timber sale areas accessed by the same road system. Project Design Criteria have been developed to protect public safety and minimize other conflicts between logging and other activities, but logging activities could still affect other users, especially if roads are closed temporarily to protect public when logging is occurring adjacent to roads.

In combination with past, present, and other planned harvest activities, either of the action alternatives would help the Forest Service to continue its stable and sustainable supply of timber. This in turn would help support the local and regional wood products industry, dependent service providers, and local economies. In summary, the action alternatives have the greatest potential to benefit the local communities in the longer term and Colorado/northern New Mexico timber industries in the short-term. Forest management can increase the rate of forest recovery and improve recreational and commercial opportunities, while increasing safety to Forest users.

3.14 Recreation and Travel Management

Scope of Analysis

The recreation analysis focuses on the recreational use in the analysis area boundary and high-use areas immediately adjacent to the analysis area boundary.

Existing Conditions

Developed Recreation - The Trujillo Meadows Campground is directly adjacent to the analysis area, and essential components of the campground water system are located in the analysis area. The access route (FSR 118) for both the Trujillo Meadows Campground and Reservoir are located in the analysis area. The

Trujillo meadows Campground was closed in 2012, for hazard tree removal (covered under a separate analysis document) and is expected to be re-opened in spring of 2014.

Dispersed recreation - A diverse array of dispersed recreation opportunities occur within the analysis area. These opportunities include but are not limited to: driving for pleasure, sight-seeing, hiking, hunting, fishing, horseback riding, picnicking, firewood gathering, snow shoeing, cross-country skiing, snowmobiling, use of all-terrain-vehicles (ATV) on roads, and use of the yurt system.

Recreation Opportunity Spectrum (ROS) Setting -The ROS is modified-roaded. The area prescriptions according to the Forest Plan Management Area Prescriptions (MAP) are General Forest (5.11) and Forest products (5.13).

System Trails/Trailheads - There are no trails or trailheads within the analysis area. Trail number 736 is located northwest of the analysis area; the access road to this trailhead traverses the analysis area. Trail number 813, the Continental Divide National Scenic Trail (CDNST), is located south of the analysis area, within a few hundred yards of NFSR 118.

Recreation Special Uses -There is one commercial recreation permittee operating in the area. The permittee operates a total of four yurts, two of which are in the analysis area, and the access route to another yurt, passes through the analysis area. PDC (chapter 2) are being employed to minimize effects to these recreationists.

Travel Management - Forest travel regulations restrict motorized travel to designated roads and trails. All of the gated roads are closed to motorized uses. Open roads are the only routes open to motorized uses within the analysis area. Additionally, forest regulations allow vehicles to leave roads for a distance of 300 feet to access a suitable campsite or for gathering firewood, as long as no damage is caused to the resources. Game retrieval is allowed in this area (afternoons with ATVs less than 48 inches in width) during the big game hunting seasons.

Direct and Indirect Effects

Alternative 1 – No Action

This alternative could have some impacts to recreationists if the widespread effects of down trees impede visitor access and/or the safety aspects of many standing dead trees preclude the use of the area. Winter recreationists may not be able to access areas until the snow is deep enough to adequately cover down trees, as they fall over time.

Alternative 2 – Proposed Action

This alternative would have temporary effects on recreation users and private land owners adjacent to the proposed treatment areas, especially during the active timber sales with heavy truck traffic on open roads leading into the sale areas. There would also be fewer opportunities for public firewood gathering than alternative 1, even with the three areas (totaling 97 acres) set aside for public firewood gathering. The two yurts under a special use permit (figure 1-2) are located in proposed salvage units. Since Project Design Criteria would allow logging only up to December 15th this cutoff date would still allow for safe winter recreational use of the area, for both the yurt visitors and dispersed recreationist, plus reduce financial impacts on the yurt permittee.

Following harvest, the area would be more open which could allow for unauthorized cross-country travel by motorized vehicles, which would be difficult to restrict without natural barriers. Additional steps may be needed to block closed roads and skid trails to motorized use. The openness of the area could also

change winter use patterns as well by allowing snowmobiles access to different areas, currently unusable due to dense tree cover. Cross country travel by snowmobiles could impact tree regeneration, as machines may clip the tops of the trees that are minimally covered by snow.

The CDNST is adjacent to the analysis area (figure 1-2). The analysis area is within the viewshed of the CDNST (defined as the 0.5 mile foreground viewed from either side of the trail). However, the majority of the trail is at a lower elevation than the analysis area, so hikers would likely only see the edge of the analysis area while traveling through, not large sections. PDC stipulate a minimum 200 foot buffer from the trail, where logging activities would not occur. The buffer would provide for the general safe distance of two tree lengths from any tree cutting/ harvesting activities for trail users, and for the trail itself and since logging activity would occur over a ridge, this should minimize visual effects and sounds during logging activity in the area.

The recreation/travel management PDC are feasible because they would be incorporated in the timber sale or other contracts to protect recreation infrastructure, warn visitors of hazards, and minimize impacts to forest users during periods of highest use. These PDC have been used on other timber sales on the Forest and should be an effective means of minimizing negative impacts to other forest users.

Alternative 3 – Limited Action

Effects of this alternative would be similar to alternative 2, except there would be fewer opportunities for firewood gathering with two designated areas (totaling 73 acres) being set aside. However, fewer acres would be in harvest areas which would allow more firewood gathering opportunities in the analysis areas outside of the designated areas. Unharvested areas would have similar effects to Alternative 1, as the standing dead trees started to fall.

Under this alternative, the special use permitted yurts would not be located in a harvest unit, but access routes to the yurts would be affected if winter logging was permitted. Therefore, PDC would only allow logging up until December 15th to reduce impacts to winter recreation and special use permittees. Hazard tree removal within 2 tree heights of the yurts would still occur under this alternative to protect the structures from potential damage.

Following harvest, some areas would be more open which could allow for unauthorized cross-country travel by motorized vehicles, which would be difficult to restrict without natural barriers. The openness of the area could also change winter use patterns as well by allowing snowmobiles access to areas they currently do not, due to heavy timber. Cross country travel by snowmobiles could impact regeneration trees, as machines may clip the tops of the trees that are minimally covered by snow.

Cumulative Effects

Since there are no additional plans for recreation facilities and the existing road network and authorizations would not change, there are no cumulative effects expected for the recreation or travel management resource.

3.15 Transportation

Scope of Analysis

This section addresses the travel ways that could be used to access, monitor, and haul timber from the Cumbres Vegetation Management project. The spatial analysis boundaries for the transportation system are limited to the analysis area boundary. The type of work required for each road and the costs associated with

the required work are displayed for the action alternatives. The direct and indirect effects of the road system on the various resources are addressed in the individual resource sections.

The transportation network that would be required to accomplish the objectives of the action alternatives has been carefully analyzed and planned through field reconnaissance, aerial photography interpretation, and extensive map analysis. The main goals in preparing the transportation plan were to minimize construction disturbance and to control impacts to the environment, while safely and efficiently accomplishing the goals of the proposed action.

Existing Conditions

The transportation system in the Cumbres analysis area was constructed to allow access for recreation, timber harvest, range management, private land access, and fire suppression. Construction occurred in stages beginning in the early 1950s. Trujillo Meadows Reservoir was constructed in 1955.

The analysis area is located north and west of State Highway 17, approximately 54 miles southwest of Antonito, Colorado. The analysis area is accessed from State Highway 17 by two National Forest System Roads (NFSRs) - Neff Mountain road, NFSR 116, and Trujillo Meadows road, NFSR 118. Neff Mountain road is a high-clearance vehicle road that trends west from Highway 17 to intersect, at its western termini, with NFSR 118. NFSR 118, maintained for passenger car use, trends north past Trujillo Meadows Campground and ends at Trujillo Meadows Reservoir. NFSR 118.1C is suitable for use by passenger cars and is used to gain foot and horse access into the South San Juan Wilderness Area. These roads would be used as haul routes for the action alternatives (figures 2-2 and 2-3).

Other Forest roads within the analysis area are either maintained for high-clearance vehicles or are unauthorized for motorized use. There are approximately 23.3 miles of NFSRs in the analysis area boundary, of which 5.8 miles have been decommissioned and 3.8 miles are closed by gates or barriers to vehicle use. All system roads are maintained by the Forest Service. The existing local roads within the analysis area are generally well located and adequate to serve the majority of the proposed project needs.

The initial Forest level Roads Travel Analysis Process (TAP) that evaluated each road was completed (USDA Forest Service 2004). Through this science-based process, the Forest staff determined a minimum road system and also identified unneeded roads, in accordance with 36 CFR 212.5. Each road within the analysis area was evaluated and recommended for either keep/maintain storage, or decommissioning. These recommendations are reflected in the current Motor Vehicle Use Map (MVUM).

Direct and Indirect Effects

Alternative 1 – No Action

The No Action Alternative would require no new disturbance and would result in no change to the existing transportation network in the area. Reconstruction and maintenance opportunities will be limited by budget constraints. Currently, road maintenance is generally done on a 5 to 7 year schedule with heavily used roads suitable for passenger vehicles (i.e. NFSR 118) receiving more frequent maintenance.

Alternative 2 – Proposed Action

Under Alternative 2, minor reconstruction would be necessary to improve road drainage and to improve the road surface on the three main haul roads (NFSRs 116, 118/118C, 119) for environmental protection. Some Maintenance Level One (closed) roads, would be temporarily used for stand treatment activities (see figure 2-2), but would be closed and reseeded upon completion of the project. Closed roads would not be opened to public travel during logging operations.

Several temporary road segments would be constructed to gain access into harvest units. Some of these temporary roads are old, non-system roads that were used in past harvest operations and some would be new construction. Type of work needed could include: surface blading, brush clearing, drainage installation, reshaping, and turnout or turn-around construction to allow for safe and efficient use by haul vehicles and trailers. All temporary roads would be closed to vehicle traffic and rehabilitated upon project completion and are treated the same for cost estimation purposes.

Table 3-21 and figure 2-2 shows the proposed transportation network and estimated cost for reconstruction or maintenance. The preliminary costs shown do not include post-harvest rehabilitation. The maintenance shown is for work required above normal pre-haul maintenance.

Table 3-21. Road system and estimated cost for road maintenance/reconstruction, Alternative 2.

Road type	Length (mi.)	Work Required	Cost Estimate
System Roads	23.4 miles	Reconstruction / maintenance	$ 84,600
Temporary Roads	8.3 miles	Construction / Reconstruction	$ 24,900

Costs for rehabilitating temporary roads, developed from past experience and the Intermountain, Southwestern, and Rocky Mountain Regions *Cost Estimating Guide for Road Construction*, are estimated to average about $ 3,000 per mile.

Alternative 3 – Limited Action

Under Alternative 3, fewer system and temporary roads would be used than in alternative 2. Road management during and following harvest activities would be the same as described under Alternative 2 in that all closed roads used during operations would be closed to vehicular and rehabilitated. Closed roads would not be open to public travel during logging operations.

Table 3-22 and figure 2-3, show the proposed transportation network needed for alternative 3. The preliminary costs shown do not include putting reopened roads to bed after treatments. The maintenance shown is for work required above normal pre-haul maintenance.

Table 3-22. Road system and estimated cost for road maintenance/reconstruction, Alternative 3

Road type	Length (mi.)	Work Required	Cost Estimate
System Roads	15.85	Reconstruction / maintenance	60,400
Temporary Roads	4.4 miles	Construction / Reconstruction	$13,200

Costs for rehabilitating temporary roads, developed from past experience and the Intermountain, Southwestern, and Rocky Mountain Regions *Cost Estimating Guide for Road Construction*, are estimated at $ 3,000 per mile.

Cumulative Effects

Since the existing road network and authorizations would not change and no future road or motorized trail construction is planned in this area, there are no cumulative effects expected for the transportation resource.

3.16 Scenic Resources

Scope of Analysis

The analysis boundary for scenic resources is located from Rio de Los Pinos Creek along Trujillo Meadows to Neff Spring, along NFDR 118 just east of the Continental Divide National Scenic Trail and to the east edge of the private land boundary.

Existing Conditions

This analysis focuses primarily on the scenery resource within the Cumbres project analysis area boundary as described in chapter 1. However, there are two other important recreation sites adjacent to the project area that will also be considered: 1) Trujillo Meadows Campground and Reservoir, which is located on the north boundary of the analysis area; and 2) The Continental Divide National Scenic Trail, located south of the analysis area boundary.

The Trailhead area for NFS Trail 736 (access point to the South San Juan Wilderness area) is accessed by driving through the analysis area on NFSRs 118 and 118.1C/118.2.

The project area is located within lands designated for multiple-use management and is part of the suitable timber base. Hazard tree removal and cleanup in the Trujillo Meadows Campground was completed in2013. This work substantially reduced the canopy cover in the campground. Although re-vegetation actions are planned following harvest, it will be many years before the trees appear mature.

Adjacent to the analysis boundary is the County Line/Wolf Beetle Timber Sale, which has very little canopy due to a previous a Forest Service and private land timber sale and large scale blowdown event that left roughly 5-10 trees per acre. The County Line/Wolf Timber Sale also harvested around the Flat Mountain Yurt. The private land that sits on the west side of the analysis area boundary was also harvested 15 years ago and left approximately 30-40 trees per acre.

The current viewshed around Trujillo Meadows Campground and Reservoir has changed dramatically in the last 5 years. These RIS sites were identified in the Existing Visual Condition mapping of Level I or II (which is defined as naturally appearing or nearly naturally appearing). This viewshed would still be considered natural appearing however, the large amount of beetle-killed trees have changed the color and texture of this landscape from heavily forested and green to gray with missing overstory canopy. There were no areas mapped as Rehabilitation in the Cumbres analysis area in the Forest Plan.

All of these events have altered the Trujillo Meadows Viewshed and Landscape Character from forested to nearly non-forested and viewers can expect to see timber harvest activities in the remaining viewshed.

Landscape Visibility and Distance Zones - Landscape visibility addresses the relative importance and sensitivity of what is seen and perceived in the landscape. Landscape visibility is affected by a number of factors including: context of viewers, duration of view, degree of discernible detail, and number of viewers. In general, the greater the number of people likely to view a landscape and the longer the duration, the more sensitive the landscape is to modification (USDA Forest Service 1995). The proximity of the viewer to the particular landscape also affects the visibility and sensitivity. Viewing distances for this analysis are: Immediate foreground (0 feet to 300 feet), Foreground (300 feet to one half mile) and Middle-ground (1/2 to 4 miles).

Concern Routes and Areas - Landscapes are viewed to varying degrees from different locations that differ in their importance. Concern Level is used to express the degree of public importance placed on landscapes viewed from travel ways and high use areas (USDA Forest Service 1995). Concern levels are placed on

routes considered to be the primary use travel ways in the analysis area. Areas of Concern include sites where visitors spend time in place and would view the surrounding landscapes. For this project these include:

- FSR 116, 118, 118C, 118.2;
- Trujillo Meadows Campground;
- Trujillo Meadows Reservoir parking and boat launch areas;
- Neff Mountain and Trujillo Meadow ski yurts (though winter use would conceal signs of activity);
- Continental Divide National Scenic Trail

Scenic Integrity Objectives (SIOs) are set during the Forest Planning process. The following is a list of the SIOs for the Cumbres Analysis area:

- **High**: refers to landscapes where the valued landscape character "appears" intact. Deviations may be present but must repeat the form, line, color, texture, and pattern common to the landscape character so completely and at such scale that they are not evident.
- **Moderate**: refers to landscapes where the valued landscape character "appears slightly altered". Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low**: refers to landscapes where the valued landscape character "appears moderately altered". Deviations begin to dominate the valued landscape character being viewed but borrow valued attributes such as size, shape, edge effect, and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

The Rio Grande Forest Plan Forest-wide Standards and Guidelines (S&Gs) identify several categories which the SIOs can be changed to the next lower objective. In section III-30 of the Forestwide S& for Scenic Resources, the standard allows for the next lowest SIO to be changed due to "...disturbance such as fire, windthrow, or insect and disease infestations". However, variations in the SIOs may dominate the valued landscape character, but must borrow from the valued attributes such as size, shape, edge effect, and pattern of natural openings and still meet the minimum requirements of the next lower objective chosen.

The proposed harvest units in the Cumbres analysis area are within both mapped SIOs "High" and "Moderate". For areas listed as "High" they would have to meet the next lowest objective of "Moderate" and for the areas identified as "Moderate" they would have to meet the next lowest objective of "Low". The Cumbres Vegetation timber harvest management activities would then have to meet the Moderate and Low landscape objective. The landscape would be expected to appear altered following harvesting activities.

As shown in figure 3-8, proposed harvest units 1, 2, 3, 16, and 20 are in mapped SIOs of "Moderate"; Proposed units 4, 6, 7, 8, and 10 are split between categories "High" and "Moderate"; and proposed units 11, 12, 13, 14, 15, 17, 18, 19, 21, and 22 are all in "High" SIOs.

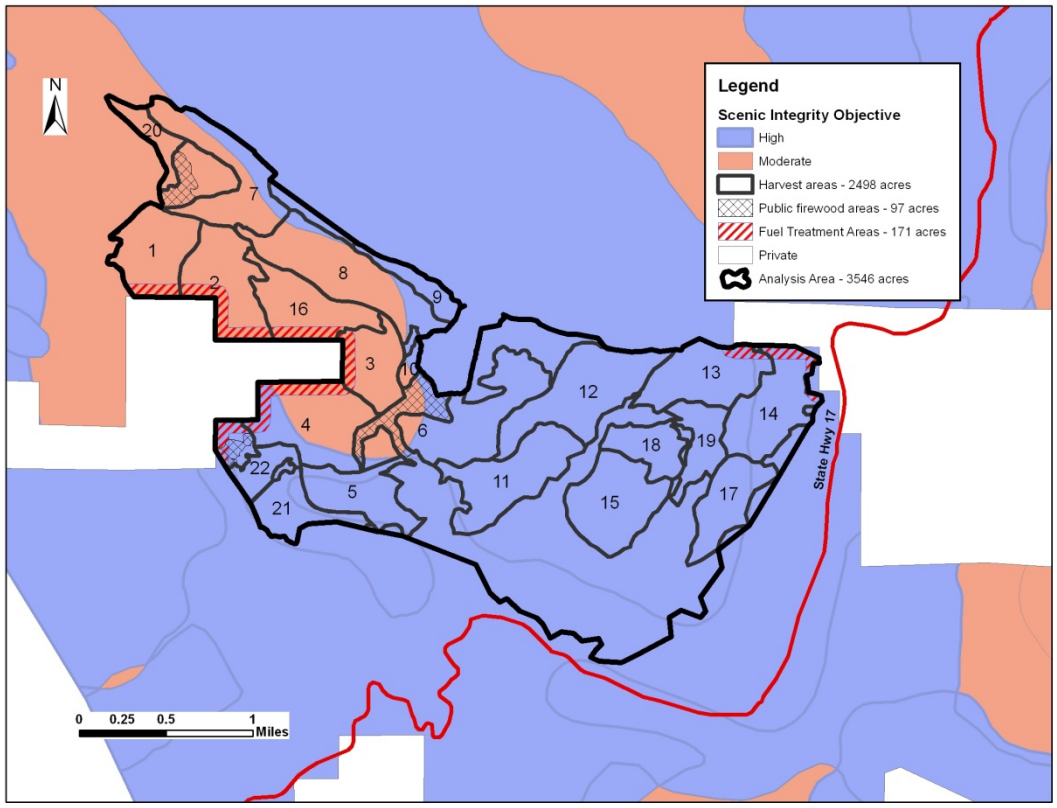

Figure 3-8. Scenic Integrity Objectives (SIOs) in relation to proposed harvest units for alternative 2.

Direct and Indirect Effects

It is important to note that landscape SIOs only apply to human activities on the ground and not natural conditions. Changes to the landscape character from forested to non-forested are considered natural and fall within the range of natural landscape variability.

Alternative 1 – No Action

Under this alternative no salvage harvest or fuel reduction activities would occur. Hazard tree removal (and firewood cutting) along FSR 118 would likely occur on an ongoing basis. On a larger-scale, no direct effects to scenic resources would result from the No Action alternative, since insect outbreak events are considered part of the overall landscape dynamic. These events would be considered a change in cover type or landscape character. Visitors can expect to see more dead or dying trees dominating the landscape. In distant views, the landscape character would appear intact to slightly altered, depending on the number of dead trees visible. In the immediate foreground and foreground viewing distances, however, the large number of dead trees can often dominate the viewshed and landscape character, negatively affecting the scenic integrity. Firewood cutting and on-going hazard tree removal would likely have some effect on scenic resources adjacent to open roads, especially if firewood cutters leave high stumps that would not be hidden by vegetation.

Although spruce beetle epidemics are a natural landscape process, the increasing amounts of dead and dying spruce would change the quality of the landscape character. Visitor response to these dynamic and changing landscapes may be unfavorable as most visitors are attached to static (unchanging) environment, especially in long-use recreation areas. There would still be texture on the landscape with the standing dead

trees; however, trees would begin to turn gray changing the overall color of the viewshed. As the tree canopy opens up, visitors may be able to see more of the ground cover. Eventually, a portion of these trees would begin to fall, again changing the texture. Seedlings and saplings would provide color and texture on the ground, but the landscape would still look dramatically different than it did a decade ago. During the winter months even more of the ground would be visible in the background viewing distances, as the canopy recedes.

Alternative 2 – Proposed Action

Salvage Harvest Activity- Units not seen from Concern Routes or Areas would have no additional effect on the scenic integrity of the landscape settings experienced by the casual Forest visitor, as management activity would not be evident. Under alternative 2, portions of units 5, 6, 8, 9, 10, 11, and Trujillo Meadows Campground harvest are expected to be seen. Additional other units may be visible as harvesting is completed and potential blowdown takes place. Under this alternative, harvest activity over a larger viewshed would actually blend human activities, so that they look more natural on the landscape. This could help mitigate some of the overall scenic impacts over time.

Visitors could expect to see changes to the surrounding landscape character as trees are harvested, but these activities would not dominate the landscape. Design features are in place to ensure that the units repeat form and line, common to the characteristic landscape. Upon project completion, the size and intensity of the action, along with lack of characteristic color or texture would result in lower scenic integrity than its current condition.

Visitors would notice changes to the landscape, relative to the large number of beetle killed trees with little or no foliage. However, visitors may not notice harvesting activities as much as if harvesting was completed in a green stand of trees. During the winter months, the background becomes more pronounced as snow accentuates the loss of the forest canopy and trees; the snow would cover most of the evidence of harvesting activities in the immediate foreground for winter visitors.

As a result of natural and managed vegetative regeneration, harvested areas would be reforested, which would begin to return the landscape to its characteristic color and texture. Regeneration would allow seen activity effects to become obscured and blend back into the surrounding landscape setting.

It is expected that visitors to the Continental Divide National Scenic Trail (CDNST) may see some activities related to timber harvesting; however, at the closest point, the Cumbres project area is roughly 200 feet from the trail and over a ridge from any direct viewing angles, which would minimize any visual impacts the harvest may have to hikers along the trail.

To further minimize harvesting activities, PDC (chapter 2) would require visible stumps to be cut to heights less than 6 inches within 100 feet of the primary roads to reduce visual impacts.

Road System Activities - Many of the roads used to access harvest units would be unseen from Concern Routes or Areas, but portions of some roads and landings could be visible; these could result a short-term effect on scenic integrity, although vegetation re-establishment would soften and blend any lines over time.

Hazard Tree Removal- Under this alternative hazard trees located adjacent to NFSRs 118 118.1C, other open roads, and recreation infrastructure would be removed as part of salvage harvest activities or cut to protect infrastructure. PDC are in place to ensure that routes or areas of concern maintain their long-term scenic integrity following hazard tree removal.

Fuel Reduction Treatments- Fuel treatments are expected to be small in nature and limited to burn piles. These may be seen from the foreground by visitors, but would not dominate the landscape character.

Designated Firewood Cutting Areas- Under this alternative, two of these areas are adjacent to NFSRs 118/118.1C. The primary effects expected to scenic resources would be additional vehicle tracks going through the stands and the high likelihood that a portion of the cut trees would be left with high stumps, which is not permitted when areas are cut as part of administered contracts. Project Design Criteria (PDC) would include the requirement that these areas be reviewed periodically for the need for Forest crews to re-cut stumps in visible areas within 100 feet of the main roads.

Alternative 3 – Limited Action

The direct and indirect effects of this alternative would be similar to alternative 2, except fewer acres would be harvested. Though the location of some the non-treated areas may have slightly different effects on what could be seen from different viewpoints. Similar to alternative 2, visitors would see evidence of stumps and harvest activities, but these activities would not dominate the landscape character.

The main differences for alternative 3 for scenic resources is the dropping from harvest consideration units 1, 2, 3, 9, and 16, which are either adjacent to identified Concern Routes and Areas described above. Although it is expected potential hazard trees would be removed along roads 118/118.1C (either as part of salvage operations or on an ongoing basis), not harvesting these units would result in less signs of human disturbance with fewer roads and landings being needed. The retention of blocks of dead and dying trees in the immediate foreground (up to 300 feet) or foreground (300 feet up ½ mile) distance could appear more natural appearance in some ways, but could also create more contrast between harvested and unharvested stands. Since treatments implemented across a viewshed often help blend human activities, so that they look more natural on the landscape, this alternative may look less natural.

Cumulative Effects

There is the potential for these proposed harvest activities to actually help rehabilitate the existing landscape. Since some of the past harvesting occurred on private land and near the area of Neff Mountain and upslope of FSR 118, the new harvest activities would have the potential to continue to open the stand canopies and blend the old timber harvests with these new units, making the entire viewshed appear more natural to visitors.

3.17 Heritage

Scope of Analysis

The scope of this analysis focuses on the potential impacts to heritage resources that might be reasonably expected from each alternative. Forest Service policy (FSM 2361.3) requires that all areas slated for ground-disturbing activities, or land which will leave Federal agency control through sale or exchange, be surveyed for heritage resources in order to comply with 36 CFR 800, the National Historic Preservation Act (NHPA) of 1966, as amended. The legal framework also requires that the Forest Service consider heritage resources as they relate to the Archeological Resources Protection Act (ARPA) of 1979 and the American Indian Religious Freedom Act (1979) and the Native American Graves Protection and Repatriation Act (1992). A detailed analysis is documented in a Section 106 National Historic Preservation Act (NHPA) report to be sent to the Colorado State Historic Preservation Office (COSHPO) for consultation (*Draft* Krall and Frye 2012). The report and consultation correspondence will be included in the project record.

The analysis for heritage resources is drawn from a summation of archival records and a Class II (sample) heritage resource inventory conducted within the Area of Potential Effects (APE) in 2011. The APE for this project is defined by those areas identified for salvage activities with high site potential, that have not experienced previous heritage resource surveys, on slopes less than 30 degrees. Because of the large scale nature of the project, a GIS model was also employed in order to define areas of high site potential by

considering the variables of slope, proximity to water and vegetation type (*Draft* Frye and Krall 2012). A Class III inventory was employed on 25 acres within the Trujillo Meadows campground unit. Forest Service archeologists also spot checked portions of the analysis area previously surveyed for heritage resources in the late 1970s. During this effort, Rio Grand National Forest (RGNF) archeologists inventoried a total of 176 new acres for heritage resources within the APE.

Existing Conditions

Cultural Resources - A pre-field literature search indicates that there have been 2,725 acres previously inventoried for heritage resources within the proposed analysis boundary (Draft Frye and Krall 2012). These surveys indicate a very low site density within the forested areas and proposed salvage units. However, some previously recorded sites are located along meadow edges within the analysis area. The previously identified archaeological sites suggest limited prehistoric seasonal exploitation of game resources and prehistoric food processing. Documented prehistoric manifestations predominantly fall within the Late Archaic (2500 BP) and Late Prehistoric (Puebloan 500 BP) eras. Some of the analysis area was subjected logging activities that occurred between the 1920s and 1950s prior to the advent of the National Historic Preservation Act (NHPA) of 1966. As such, it is possible that heritage resources have been previously impacted within the project area, though no direct evidence of past impacts was observed. Livestock grazing has occurred in the region over the past 100 years likely contributing to the cumulative impacts on heritage resources over time.

According to the 2004 revised regulations [36 CFR 800.4(d) (1)] for Section 106 of the *National Historic Preservation Act* (16 U.S.C. 470f) the recommended determination for the proposed action is ***no adverse effect*** if design criteria are followed. Under the implementing regulations of Section 106 of the National Historic Preservation Act (36 CFR 800), sites considered not eligible to the NRHP may be directly affected once adequately recorded, evaluated, and concurrence is received from the State Historic Preservation Office regarding NRHP eligibility. **Project concurrence was received from the COSHPO Office on June 25, 2012.**

Osha (Ligusticum porteri) - The analysis area contains a robust population of the unique medicinal plant known as Osha (Ligusticum porteri), a plant widely used by Native Americans, Hispanic communities, and increasingly, by the herbal industry (Figure 1). The plant's collection and use has deep cultural connections to local peoples through time, and therefore warrants analysis within the purview of heritage resources.

The plant is in the *Apiaceae* family and grows at higher altitudes, usually above 6,000 feet, often in moist aspen groves but also found in well drained and disturbed areas such as old clear-cuts and burned areas.

During the initiation of Cumbres project it was recognized that the *Osha* plant is plentiful within and surrounding the proposed project area(s). *Osha* is an ethnobotanically important plant and its odiferous roots are currently wild harvested by individuals and herbal product companies for the sale and use in treating a variety of ailments. Some believe the plant is being over-harvested and that climate change may be impacting the plant's traditional range. Initial scoping revealed the concerns from some public that timber salvage could negatively impact *osha* populations. In response to these questions and concerns, the Rio Grande National Forest, in partnership with University of Kansas, launched a multi-year field project in 2011, built on the previous work of Botanical Liaisons LLC (2002-2007), which is included in appendix C.2. The current study design has two objectives:

1) Determine population density in the wider region by creating large polygons around the perimeters of geographically distinguished populations and sampling vegetative cover within. Eight polygons were created around a cumulative area of 507,597 square meters of *osha* populations with an average of 7.8% cover (Kindscher et al 2012). Most of the populations appear robust and exist, in

many cases, within previously clearcut areas. Polygons that overlap proposed Cumbres cutting units will be monitored for potential impacts to the plants.

2) Analyze *osha's* density and resistance to harvest by setting up experimental plots in both a Meadow landscape (previously harvested) with high light availability and in a Forested landscape with significant canopy cover. At both sites 40 replicate 30m2 plots were established, data was collected on vegetative cover, and roots were harvested at intensities alternating sequentially between 0%, 33%, 66%, or 100% of mature plants in each plot. The Meadow site had 15% more mature plants and 58% more root mass than the Forested site. From the data it is estimated that a meadow population exhibiting a 10% cover (a dense stand of *osha*) will have on average 52.2 g dried root weight per 1 m2 area (465 lbs/acre), while a forest population exhibiting a 9% cover will have on average 13.7 g dried root weight per 1m2 area (122 lbs/acre) (Kindscher et al 2012). Baseline data were successfully gathered in 2012 and in 2013 post-harvest regrowth data was collected and a report with be generated by 2014. These data will help to determine sustainable rates of harvest and inform conservation measures needed to ensure the long-term viability of this species.

It is hoped that the Forested plots will eventually be a part of a salvage unit in order to gauge the plant's response. Currently, the study plots are signed as a 'research area' to deter public from collecting in that location.

Direct and Indirect Effects

Alternative 1 – No Action

Cultural Resources - Since this alternative includes no additional ground-disturbing activities, the potential for inadvertent discoveries of and damage and destruction to buried cultural deposits and aboriginal human remains would be negligible. This alternative would have no direct effect on significant heritage resources and no mitigation or monitoring activities would be necessary. However, the fuel loading that would occur under the No Action Alternative could result in negative indirect effects to significant historic resources (wooden buildings), if large scale wildfires sweep over the region.

Osha - This alternative would have no direct effects on *Osha.* The canopy will naturally open as a result of the spruce die-off from the beetle epidemic providing more understory habitat for osha recruitment. Under this alternative, fuel loading would increase with the dead and dying trees and fires would have a greater potential to open areas for the plant's expansion.

Alternative 2 – Proposed Action

Cultural Resources - Salvage, fuels reduction treatments (thinning), tree planting, landings and new road construction all have the potential to negatively impact heritage resources. Direct negative effects could include the potential destruction and/or alteration of unidentified heritage resources and contexts within the APE. Activities such as road maintenance and the opening of old roads would not be expected to directly impact heritage resources, if maintenance is relegated to the original road foot print. New temporary road construction has the potential to negatively affect unidentified buried cultural deposits for all the action alternatives. Indirect effects from project activities can include the erosion of buried cultural deposits precipitated by temporary road construction and the removal of trees. Potential indirect effects from vandalism to heritage resources perpetrated by individuals associated with project activities is possible under each action alternative.

While there is potential for direct negative effects to unidentified heritage resources from ground disturbing activities during salvage (2,498 acres), planting (650 acres) new temporary road construction (0.8 miles), landings (22 acres), public firewood cutting (97 acres), and fuels reduction through thinning (171 acres),

the potential for negative direct effects is very low. Much of the area has been previously inventoried for heritage resources revealing a very low site density. Therefore, the potential for negative direct, indirect and cumulative effects to unidentified heritage resources is very low. Potential indirect effects from vandalism to heritage resources perpetrated by individuals associated with project activities is possible under each action alternative is also unlikely due to the low archaeological site density and visibility.

Osha- Timber harvest activities could potentially impact individual *Osha* plants, but potential for direct negative effects to whole populations is low. Undocumented historic collection areas may be negatively impacted in the short term. Potential positive indirect effects may include the expansion of *Osha* populations into disturbed areas where the canopy has been opened.

Alternative 3 – Limited Action

Cultural Resources - The potential of direct, indirect and cumulative effects to unidentified heritage resources from ground disturbing activities during sanitation/salvage (1,549 acres), planting (170 acres) public firewood cutting (73 acres), fuels reduction through thinning (171 acres), landings (15 acres) and new road temporary construction (0.1 miles) is the lowest of the two action alternatives. Because so much of the area has been previously inventoried for heritage resources and because there is a very low site density, the potential for negative direct, indirect and cumulative effects to unidentified heritage resources is low within this limited action alternative.

Osha- Timber harvest activities could potentially impact individual *Osha* plants, but potential for direct negative effects to whole populations is low. Undocumented historic collection areas may be negatively impacted in the short term. Potential positive indirect effects may include the expansion of *Osha* populations into disturbed areas where the canopy has been opened.

Cumulative Effects

The loss of archaeological resources has happened in the past and will happen in the future. The cumulative effect is that over time fewer archaeological resources will be available to learn about past human lifeways, to study changes in human behavior through time, and to interpret the past to the public. Heritage resource inventory, recording, evaluating and archiving basic information about each site for future reference serves to partially mitigate potential cumulative effects to heritage resources. In conjunction with the proposed project, previous logging activities, recreation activities such as hunting, and livestock grazing have the potential to cause ground disturbance and lead to cumulative, long term, irreversible adverse effects to heritage resources. However, because the archaeological site potential appears very low within the analysis, the potential for negative cumulative effects is also low.

3.18 Compliance with Other Relevant Laws, Policy, Direction

Short-term Uses and Long-term Productivity

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The relationship between the short-term uses of the environment and the maintenance and enhancement of long term productivity is complex. For this analysis, it was assumed that short term uses were those that

generally occur on a yearly basis (i.e. livestock grazing as a use of the forage resource, timber harvest as a use of the available wood resource, and recreation uses).

Long term refers to longer than 10 years. Productivity refers to the capability of the land to provide market and non-market outputs and values for future generations. Soil and water are the primary factors of productivity and represent the relationship between short term uses and long term productivity.

Both Action Alternatives studied in detail, incorporate sustained yield of resource outputs in varying degrees, while maintaining resource productivity. The specific Project Design Criteria included in the alternatives ensures that long term productivity would not be impaired by the application of short term uses. Therefore, for every alternative, the long term productivity is assured. This conclusion is based on disclosures for each resource in chapter 3 and silvicultural findings in the project file.

Unavoidable Adverse Effects

This section describes adverse effects that are unavoidable with implementation of action alternatives. For further discussion, see the resource topics in chapter 3.

Unavoidable adverse effects are similar for each action alternative evaluated, except alternative 3 proposes activities on fewer acres, so the scope of any adverse effects is less. These include some additional detrimental soil disturbance resulting from logging activities. Some damage to understory trees that are important for dense horizontal cover (DHC) for snowshoe hare, the main prey species for lynx, is also expected. Local air quality would be adversely affected on a temporary/seasonal basis as a result of burning hand or machine piles. Spruce beetles will continue at epidemic levels in the area. Soils can be compacted by the use of ground based logging equipment and soil can erode when vegetative cover is disturbed.

Project Design Criteria and mitigation measures described in chapter 2 would be used to minimize adverse effects caused by activities. No Action could have adverse economic effects on local timber producers and could also create access problems for people, livestock, and big game. No action would also increase the potential to damage existing infrastructure and create long-term maintenance problems.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. For further discussion of effects on the resources listed below, see chapter 3 under the resource topics

Irreversible resource commitment applies primarily to the use of nonrenewable resources, such as minerals or Heritage resources, or those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.

Two types of irreversible resource commitments would occur as a result of implementation of any of the action alternatives:

- **Energy Resources**: Fossil fuels used in processing wood products which would result from an action alternative would be an irreversible loss.
- **Other Resources**: There could be a limited irreversible loss in soil/rock resources used in road reconstruction by use of existing and potential borrow pits.

No other irreversible resource commitments were determined as a result of the implementation of an action alternative.

Irretrievable commitment of resources includes:

- **Vegetation:** Where permanent roads are constructed or reconstructed and the soil displaced, there is an irretrievable loss of the type of vegetation that occurs. For temporary roads, skid trails and landings, vegetation is re-established on the disturbed areas, but the type of vegetation may be changed from timber to grasses and forbs in these areas, at least in the short to mid-term.
- **Scenic condition:** Where trees are harvested there would be an irretrievable loss of an unaltered environment from selected routes or areas of concern in the short term (refer to Scenic section). It is estimated that recovery would begin within five years following harvest and would meet scenic integrity objectives within a maximum 20 to 25 years, depending on the number of remaining live trees and aspen response.
- **Social/Economic**: Where there is no commercial wood fiber recovered, such as No Action, there would be an irretrievable loss in income and employment in the local economy for a short period of time, or, until new sources of supply could be found. Refer to the Social/Economic section for detailed discussions by alternative. To compensate for a lack of supply of timber, firms reach outside their normal market area for sources of supply. This, in turn, drains resources available to other firms, who then must reach outside their market areas, creating a ripple effect.
- **Wildlife habitat:** loss or modification of habitat for some species of wildlife is likely under the action alternatives (see Wildlife section). As vegetation recovers, habitat would eventually return over various periods of time depending on the amount of spruce beetle mortality, stand composition, and alternative implemented.

Other Required Disclosures

Global Climate Change

The Forest Service acknowledges that global climate change is an important emerging concern worldwide. However, there is no established scientific methodology to measure the effects of small-scale projects such as this project on global climate. This analysis briefly addresses global climate change in two ways: 1) effects of climate change on a proposed project, and 2) effects of a proposed project on climate change. Each of these is briefly discussed below relative to this project.

Effects of climate change on a proposed project - The National Environmental Policy Act (NEPA) does not specifically require analysis of how environmental factors, such as global climate change, might impact a proposed action. Any differences in effects of climate change on the project between alternatives (including no action) would be negligible.

Effects of proposed project on climate change - The proposed activities are extremely small in scope and magnitude relative to a planetary scale. Although it may be possible to quantify a project's direct effects on carbon sequestration and greenhouse gas (GHG) emissions, there is no certainty about the actual intensity of individual project indirect effects on global climate change. Cumulative effects would be a consideration of GHG emissions affecting climate from multiple projects over time. But, as GHG emissions are integrated across the global atmosphere, it is not possible to determine the cumulative impact on global climate from emissions associated with any number of particular projects. Nor is it expected that such disclosure would provide a practical or meaningful effects analysis for project decisions. Any differences between alternatives (including no action) would be negligible at a global scale.

Forest Plan Consistency

As disclosed in chapter 1, this EIS is tiered to the Final Environmental Impact Statement for the Rio Grande National Forest Land and Resource Management Plan, as amended (Forest Plan). It documents the analysis in the second level of planning.

As part of the Forest Plan, land has been divided into Management Area Prescriptions (MAPs) which differ from each other in resource emphasis. The MAPs that fall within the Cumbres Project area were fully discussed in chapter 1; spatial location of these MAPs within the project area can be found in figure 1-2, chapter 1 of this EIS.

Disclosures within this EIS and project file resource reports clearly display that implementation of the Action Alternatives, including the Project Design Criteria, mitigation, and monitoring measures, are consistent with the Forest Plan standards and guidelines, Desired Conditions (goals) and objectives. Implementation of either action alternative would contribute toward meeting Forest Plan Desired Conditions and objectives for MAPs 5.11 and 5.13, which are part of the suitable timber base.

National Forest Management Act (NFMA)

The Forest Plan was prepared under the 1982 Planning Rule (36 CFR 219, 1982 version) require that NFMA findings be documented at the project level. The action alternatives are fully consistent with vegetation management requirements under the NFMA. The detailed NFMA Consistency Report is located in the project record.

Clean Water Act

The Clean Water Act (CWA) requires each state to implement its own water quality standards. Designated uses include agriculture, domestic water source, recreation primary contact, and aquatic life cold water. Status is listed as good for all designations, except aquatic life which has not been assessed. The Beneficial Uses and good quality of water in the streams in the project area would be maintained during and following project implementation through the proper implementation of BMPs and Project Design Criteria, chapter 2.

Clean Air Act

Based on discussions in chapter 3 concerning Air Quality, it has been determined that there would be no measurable effects to air quality in class I or II airsheds relative to any of the alternatives. Dust from harvest activities and smoke from pile burning would be short-term and temporary. Dust abatement would be used on the main travel route during dry periods. Burning would also be conducted only as approved by the State of Colorado. This project would fully comply with the Clean Air Act.

Executive Order 11990

This order requires the Forest Service to take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In compliance with this order, Forest Service direction requires that an analysis be completed to determine whether adverse impacts would result.

Both action alternatives would be compliance with this E.O since no ground disturbing activities would occur within 100 feet of any wetland, seep, or spring. These areas have been or would be identified prior to implementation. Impacts from adjacent or nearby areas will be prevented through implementation of Project Design Criteria.

Endangered Species Act

Based on discussions in chapter 3 concerning threatened, endangered, and proposed wildlife species and analysis contained in the draft Biological Assessment located in the project file, it has been determined that the effects of the action alternatives would be in compliance with the 2008 Southern Rockies Lynx Amendment, but still "*may affect, likely to adversely affect*" Canada lynx due largely to the compounding factor of the loss of food for red squirrels, an important secondary lynx prey, resulting from ongoing spruce beetle activity. Habitat would remain suitable for wolverine under all alternatives.

The Biological Evaluations for plants and wildlife, located in the project record, also determined that the project alternatives would not adversely impact any Regional Sensitive species to any extent that would cause a trend toward federal listing.

Roadless Area Conservation

Both action alternatives comply with the current Forest Plan Inventoried Roadless Areas and Colorado Roadless Rule management direction, since there would be no management activities proposed in a designated roadless area.

Executive Order 12898 - Environmental Justice Act

Executive Order 12898 directs Federal agencies to focus attention on human health and environmental conditions in minority and low income communities. The purpose of the executive order is to identify and address, as appropriate, disproportionately high adverse human health or environmental effects on minority and low income populations. Table 3-23 summarizes population and household income data for Conejos and Rio Arriba counties.

Table 3-23. Population information, Conejos (CO) and Rio Arriba (NM) counties.

County	Acres by Ownership[a]		Population Information		Median Household Income (2006-2010)	% Below Poverty (2006-2010 income)
	Public[e]	Private				
Conejos	545,261	280,892	**Total**	**8,256**	$33,627	17.7%[b]
			%White	41.8		
			%Hispanic/ Latino	56.0		
			%American Indian	2.2		
			% Other Races	<1		
Rio Arriba	1,471,635	2,301,789[d]	**Total**	**41,190**	$41,437	19.7%[c]
			%White	12.8		
			%Hispanic/ Latino	71.3		
			%American Indian	16.0		
			% Other Races	<1		

[a] (EPS-HDT 2011b); [b](U.S. Census Bureau 2011c); [c](U.S. Census Bureau 2011d);[d] Private and Tribal lands; [e] Includes Forest Service, BLM, and State. http://quickfacts.census.gov/qfd/states/

Based on the information available, neither county would be considered low income, but both counties would have a minority population, as defined by Executive Order 12898 (CEQ 1997, Romero et al. 2001).

There is no evidence to suggest during scoping or public involvement process that the proposed action or any of the alternatives would have a disproportionate adverse effect on low-income or minority populations.

Based on information provided in this section and the Air Quality section, no adverse impacts are expected on any populations. No concerns have been identified by minority populations.

The action alternatives would provide more potential for economic benefit and diversity that could benefit local populations in a variety of ways. Though the No Action alternative may not provide direct or indirect benefits, it would be unlikely to cause measurable harm either.

Cumulatively, the addition commercial forest products and firewood that would be made available to area residents from salvaging dead and dying trees on suitable timber lands from the Cumbres project would continue to provide economic opportunities to area residents.

Plans and Policies of Other Jurisdictions

As evidenced from responses to scoping, and other public involvement solicitations, no conflicts have been identified between the objectives of other Federal, State, and local governments and Indian tribes, with the action alternatives, nor have any been identified relative to No Action.

CHAPTER 4. List of Preparers and Contributors

Table 4-1. Interdisciplinary Team Members

Core IDT Members	Education	Years Professional Experience	Position Title/ *IDT Role*
Diana McGinn	BS Range-Forest Management; BS Wildlife Biology, Colo. State Univ.	27	Natural Resource Planner *IDT Leader*
Michael Tooley	BS Forestry, Oklahoma State Univ.	16	Supervisory Forester *Forest Health & Timber Management*
Chris Boone	BS Wildlife Biology, Adams State College.	10	Acting Wildlife Biologist *Wildlife*
Vaughn Thacker	MS Soil Fertility & Plant Nutrition & Ag System Technology, Utah State Univ. BS Environmental Soil & Water Science, Utah State Univ.	8	Soil Scientist *Soils / Air Quality*
Sid Hall	Technical Fuels Management Applied Science-Animal Health, Adams State College	13	Prescribed Fire & Fuels Specialist *Fire & Fuels*
Negussie Tedula	BSc Agro-Engineering, Alemaya Univ. MS Soil & Water Engineering, Natl. Univ. of Ireland PhD Hydrology, Univ. of Georgia	10	Hydrologist *Hydrology, Watershed, Aquatics*
Supporting IDT Members			
Amanda Walker	BS Conservation Science, Musknigum Univ.	12	Recreation Management *Recreation & Travel Management*
Kelly Ortiz	BA Literature, Syracuse Univ. MLA Landscape Architecture, State Univ. N.Y.	19	Landscape Architect/ *Scenic Resources*
Dean Erhard	-BS Forestry, University of Mont. -MS Rangeland Resources, Oregon State Univ.	27	Ecologist (retired) *TES Plants*
Gary Frink	BS Geology, Adams State College	28	Engineer/ Transportation planner *Transportation*
Luciano Sandoval	BS Biology, Adams State College	11	Rangeland Management Technician *Rangeland & Weeds*
Angie Krall	-BA Anthropology Colorado College -MA Applied Anthropology, Northern Arizona University	21	Archeologist *Heritage*
Barry Wiley	-MS Wildlife Biology, Southwest State Texas Univ.- BS Wildlife Management, Southwest State Texas Univ.	18	Fisheries Biologist *Fisheries*
Kevin Duda	MS Forestry, Colo. State Univ. BS Forestry, Colo. State Univ.	6	Forester *Social/Economics*
Milo Medina	BS Wildlife Biology, Adams State University	3	*Forester* *GIS*

Federal, State, and Local Agencies

The Forest Service consulted the following Federal, State, and local agencies and groups, Tribes, and non-Forest Service persons during the development of this document.

Table 4-2. Agencies and Tribes Consulted
Colorado Parks and Wildlife
Environmental Protection Agency
US Fish and Wildlife Service
Colorado State Historic Preservation Office
Conejos County Commissioners
[a] *Also received a DEIS notification letter*
Ute Tribe of the Uintah & Ouray Reservation
Navajo Nation
Pueblo of Santa Ana
Taos Pueblo
Pueblo of Nambe
Ohkay Owingeh
Hopi Tribe
Santa Clara Pueblo
San Ildefonso Pueblo
Jicarilla Apache Tribe
Santa Domingo Pueblo
Pueblo de Cochiti
Southern Ute Indian Tribe
Ute Mountain Ute Tribe
[a] *Also received a DEIS notification letter*

Distribution of the Environmental Impact Statement

This draft environmental impact statement has been sent to the following individuals, Federal agencies, federally recognized tribes (see above), State and local governments, elected officials, and organizations representing a wide range of views.

Table 4-3. DEIS Notice of Availability Contacts

Contact	Format	Contact	Format
Adam Moore, Colorado State Forest Service	letter	Leonard Canto	letter
Alpine Lumber & Log Home Co.	letter	Leroy & Michelle Salazar	letter
Alfred Redwine	letter	Linette Perona	letter
Antonito Chamber of Commerce	letter	Mack Sowards	letter
Arthur Trujillo	letter	Mark Pearson, San Juan Citizens Alliance	letter
Andrew Hurd, Hurd Brothers Logging	letter	Mary Ann Deboer, Cumbres Nordic Adventure	letter
Anthony Moore, Independent Log Company	letter	Mary Romano, Sierra Club	letter
Alvin Freibert	letter	Matt Norton	letter
Arlyn & Cynthia Sowards	letter	McKown & McKown Limited Liability	letter
Bill Manning, Colorado Trail Foundation	letter	Melody Holland	letter
Blake Sowards	letter	Miguel Lujan, Conejos City Administrator	letter
Brent Woodward, Colorado Parks and Wildlife	letter	Michael Rue	letter
Brett Shawcroft, SLV Cattlemen's Association	letter	Mike Rupert	letter
Brian Rue, Rue Logging, Inc	letter	Monte Vista Chamber of Commerce	letter
Bryan Bird, WildEarth Guardians	letter	Nancy Fishering, Colorado Timber Industry	letter
Cathy Bear, Chama Valley Outdoor Club	letter	Nature Conservancy	letter
Carlyn Sowards	letter	Paul Sowards	letter
Charles McDonald, US Fish & WL Service	letter	Pete Deherrera	letter
Chama City Hall	letter	Raymond Johnson, Rincones Ranch	letter
Conejos Water Conservation District	letter	Randy Keys, Cottonwood Meadows Guide Service	letter
Conejos County Land Use Administrator	letter	Richard Doyon, Rocky Mountain Timber Products, Inc	letter
Conejos County Commissioners	letter	Rick Basagoitia, Colorado Parks & Wildlife	letter
Continental Divide Trail Alliance	letter	Richie McDaniel	letter
Cumbres Nordic Adventure	letter	R. E. Vann, Director Renewable Resources, Rocky Mountain Regional Office	letter
Conejos Ranch Outfitters	letter	Rocky Smith,	letter
Diana Alcala	letter	Rodney King	letter
Dick Artley	letter	Ron Pleasant, Pleasant Logging & Milling Inc.	letter

Table 4-3. DEIS Notice of Availability Contacts

Contact	Format	Contact	Format
Divide Timber	letter	Kolish Lumber Inc.	letter
Depps Transportation & Houselogs	letter	Kurt Broderdorft, US .Fish & Wildlife Service	letter
Dennis Moeller, La Manga Livestock Association	letter	Larry Sowards	letter
Dorothy Sowards	letter	Lester Bagwell	letter
Doug MacLennan, Southwest Nordic Center	letter	Ryan Bidwell	letter
Dwaine Rue	letter	Sam Satterwhite, DBA Satterwhite Log Homes	letter
Ecological Services, US Fish & Wildlife Services	letter	Scenic Canyons Recreational Services	letter
Elwin & Lena Sowards	letter	Steve Sutherland	letter
Estate of Thomas & Deanna Cater	letter	Steven L. Russell	letter
Fred Speechly	letter	Stimpson Lumber Co.	letter
Garth Sowards	letter	Tanner Bagwell	letter
Greg Sowards	letter	Tehri Parker, Rocky Mountain Wild	letter
General Manager, Cumbres Toltec Railroad	letter	Ted Krings	letter
Gilbert Duran	letter	Todd Enterprises, Inc.	letter
Greg Oryking	letter	Tom Troxel, Intermountain Forest Industry Association	letter
Harry Landers, Wild Horse Outfitters	letter	Thomas Elnora	letter
International Mountain Biking Association	letter	Tracy Miller, NRCS	letter
James Wolf, Director Continental Divide Trail Society	letter	U.S. Environmental Protection Agency, EIS filing section	letter, CDs
Jacob Smith, Center for Native Ecosystems	letter	U.S. Environmental Protection Agency, Region 8	letter, CDs
Jason Miller	letter	William Joe & Roberta Kostka	letter
Jessica & Jeffery Egnew	letter	Veronica Eagan, Great Old Broads for Wilderness	letter
Jim Braiden, Braiden Cattle Co.	letter	William H. Moore	letter
Joanie Berde, Carson Forest Watch	letter	Steve Sutherland	letter
Joan Nemyers	letter	SLV Ecosystem Council	letter
Joanna Skinner	letter	Steve Sutherland	letter
John Baxter, Mountain Valley Lumber	letter	Steven L. Russell	letter
John Robins	letter		
J. Wenum, Colorado Parks & Wildlife	letter		
Jon Harp, Conejos River Anglers	letter		
Josephine Trujillo	letter		
Kathleen Ivie	letter		
Kelly & David McGinnis	letter		
Kenneth Freibert	letter		

Table 4-3. DEIS Notice of Availability Contacts

Contact	Format	Contact	Format
Office of Honorable Mark Udall	CD, letter		
Office of Honorable Michael Bennet	CD, letter	Office of Honorable Larry Crowder	CD, letter
Office of Honorable Scott Tipton	CD, letter	Office of Honorable Edward Vigil	CD, letter
Acquisitions & Serials Branch, National Agricultural Library	CD, letter		
Chief of Naval Operations (N45), Energy and Environmental Readiness Division	letter	Director, NEPA Policy & Compliance, DOE	letter
Deputy Director APHIS PPD/EAD	letter	Director, Planning and Review, Advisory Council on Historic Preservation	letter
Director OEPC	letter	Federal Highways, Colorado HDA-CO	letter
Director, NEPA Policy & Compliance, DOE	letter	Libraries - Documents Processor, Colorado State University	Hardcopy
Director, Planning and Review, Advisory Council on Historic Preservation	letter	National Environmental Coordinator, NRCS	letter
Acquisitions & Serials Branch, National Agricultural Library	CD, letter	Regional Director, Northwest Mountain Region, Federal Aviation Administration	letter
Chief of Naval Operations (N45), Energy and Environmental Readiness Division	letter	U.S. Army Corps of Engineers, Northwestern Division	letter
Deputy Director APHIS PPD/EAD	letter	U.S. Army Corps of Engineers, South Pacific Division CESPD-CMP	letter
Director OEPC	letter	U.S. Coast Guard, Environmental Impact Branch G-MEP	letter
Director, NEPA Policy & Compliance, DOE	letter	National Environmental Coordinator, NRCS	letter
Director, Planning and Review, Advisory Council on Historic Preservation	letter	Regional Director, Northwest Mountain Region, Federal Aviation Administration	letter
Deputy Director APHIS PPD/EAD	letter	U.S. Army Corps of Engineers, Northwestern Division	letter
Director OEPC	letter	U.S. Army Corps of Engineers, South Pacific Division CESPD-CMP	letter
		U.S. Coast Guard, Environmental Impact Branch G-MEP	letter

APPENDICES

APPENDIX A

Table A.1. Commonly used terms and definitions

Term	Definition
Artificial Regeneration	A group or stand of young trees created by direct seeding or by planting seedlings or cuttings
Basal area (BA)	Cross-sectional area, in square feet, of a tree measured at dbh, diameter at breast height (4.5 feet above ground).
Board Foot (BF)	Measure of an amount of timber equivalent to a piece of lumber 12 inch by 12 inch by 1 inch.
Coarse Woody Debris (CWD):	Woody materials greater than 3 inches in diameter.
Commercial Forest Products	Sawlogs, small roundwood, biomass, and other forest products removed in the process of harvesting or cutting trees from NFS lands.
Cover Type	A taxonomic unit of vegetation classification referencing existing vegetation. Cover type is a broad taxon based on existing plant species that dominate, usually within the tallest layer.
Desired Conditions	A set of ideal conditions established for a Management Area Prescription within the Forest Plan. These conditions are the goals for the Management Area and the intended end results for all actions taken within it. Desired Conditions for each specific Management Area Prescription are outlined in Chapter IV of the Revised Land and Resource Management Plan of the Rio Grande National Forest.
Endangered plant:	A plant that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Even-aged management	The application of a combination of actions that results in the creation of stands in which trees of essentially the same age grow together. The difference in age between trees forming the main canopy level of a stand usually does not exceed 20 percent of the age of the stand at harvest rotation age. Regeneration in a particular stand is obtained during a short period at or near the time that a stand has reached the desired age or size for regeneration and is harvested.
Existing Scenic Integrity	Represents the status of the landscape and the degree to which it has been altered. This is a baseline measurement for Scenic Resources. The following is a list of the Scenic Integrity Levels: • **Type I** (Natural Appearing Landscapes)-areas in which on ecological change has taken place except for trails needed for access. They appear untouched by human activities. This included wilderness and primitive areas. • **Type II** (Slightly Altered Appearing Landscapes)-areas where some human activity has occurred. Usually these areas can be described as near natural appearing or slightly altered. • **Type III** (Altered Appearing)-areas where human modification has occurred and is obvious. Usually these areas are described as altered.
Fine Slash	Branches, leaves and limbs less than 3 inches diameter.
Fire Behavior	The manner in which a fire reacts to the variables of fuel, weather, and topography
Fuel Break	A wide strip or block of land on which the fuels have been modified so that fire burning into it can be more readily contained.
Fire Intensity	The rate of energy or heat release per unit time, per unit length of fire front, regardless of its depth.
Fuel Loading	The amount of fuel on site expressed in Tons per Acre.
Fuel Profile	The representation of various fuel characteristics (size class, loading, volatility, density, etc.) in terms of vertical and horizontal arrangement, amount, and continuity.
Fire Regimes	The nature of fires occurring over extended period of time. Fire Regimes reflect the fire environment, and influence the type and abundance of fuel, thereby affecting fire behavior and fire effects through time.
Fire Severity	A qualitative indicator of the effects of fire on an ecosystem, whether it affects the forest

Term	Definition
	floor, canopy, or some other part of the system.
Fuels	Available vegetation, both live and dead that is capable of combustion and can contribute to fire spread.
Group Selection Harvest	An uneven-aged harvest system in which trees are removed and new age classes are established in small groups, rather than evenly-spaced individual trees. Natural regeneration is thereby established in pockets, but still under the protection of a partial forest canopy.
Heritage Resources	Are sites, features, and values having scientific, historical, educational, and/or cultural significance. They include concentrations of artifacts, structures, landscapes, or settings of for prehistoric or historic events.
Heritage Resource Inventory	A systematic on-the-ground search designed to identify the locations of heritage resources. Heritage resources identified in such inventories are recorded on State of Colorado cultural resource site forms which includes determination of the significance of individual sites.
Historical Range of Variability	A method to understand the dynamic nature of ecosystems; the processes that sustain and change ecosystems; the current state of the ecosystem in relationship to the past; and the possible ranges of conditions that are feasible to maintain.
Indicator	A measurement of a resource quantity or quality, which is linked to a cause-and-effect relationship and responsive to a key issue. Indicators are used to compare the effects among alternatives, and are most generally quantitative, rather than qualitative, in measure.
Intermediate Shelterwood Harvest	One intermediate step of the shelterwood harvest system in which the canopy cover is opened up through the removal of mature trees to promote natural regeneration and stand vigor. This step is prior to final harvest.
Key Issue	A concern expressed over the potential effects of a proposed action on the human environment, due to the geographic extent, duration, or intensity of interest or resource conflict. Key issues are used to develop and compare alternatives, prescribe mitigation measures, and analyze the environmental effects. For an issue to be considered Key, it must be relevant to the specific project and appropriately addressed at that level
Ladder Fuels	Intermediate height fuels
Landtype Association	An ecological mapping unit based on similarities in geology, soils, and plant associations. Repeatable patterns of soil complexes and plant communities are useful in delineating map units. LTAs are an appropriate ecological unit to use in Forest- or area-wide planning and watershed analysis. On the RGNF, soil mapping units were aggregated into 13 distinct LTAs.
Long-Butt	A section cut from the bottom log of a tree and culled because of rot or other defect.
Natural Regeneration	The establishment of a plant or a plant age class from natural seeding, sprouting, suckering, or layering.
National Forest System road ~	A forest road other than a road which has been authorized by a legally documented right-of-way held by a State, county or other local public road authority.
Non-system Road	Also termed “Unclassified Roads.” Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1).
Noxious Weeds	A plant specified by law as being especially undesirable, troublesome, and difficult to control.

Term	Definition
Operational maintenance level	The maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained (FSH 7709.59, 62.3). **Maintenance levels** ~ Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria. **Level 1.** Closed roads that have been placed in storage between intermittent uses. The period of storage must exceed 1 year. Basic custodial maintenance is performed to prevent damage to adjacent resources and to perpetuate the road for future resource management needs. These roads are not shown on motor vehicle use maps. **Level 2.** Roads open for use by high clearance vehicles. Passenger car traffic, user comfort, and user convenience are not considerations. Motorists should have no expectations of being alerted to potential hazards while driving these roads. Traffic is normally minor. **Level 3.** Maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Warning signs and traffic control devices are provided to alert motorists of situations that may violate expectations.
Preparatory cut	An optional type of cut that enhances conditions for seed production and establishment applied under the shelterwood regeneration methods.
Reforestation	The re-establishment of forest cover, either naturally or artificially. This process usually maintains the same forest type and is done promptly after the previous stand or forest was removed.
Regeneration method	Cutting procedure by which a new age class is created. The major methods are clearcutting, seed-tree, shelterwood, selection, and coppice. Regeneration methods are grouped into: coppice, even-aged, two-aged, and uneven-aged.
Road decommissioning	Activities that result in the stabilization and restoration of unneeded roads to a more natural state." (36 CFR 212.1, FSM 7705- Transportation System) The Forest Service Manual (7712.11- Exhibit 01) identifies five levels of treatments for road decommissioning which can achieve the intent of the definition. These include the following: 1) Block entrance; 2) Revegetation and waterbarring; 3) Remove fills and culverts; 4) Establish drainageways and remove unstable road shoulders; 5) Full obliteration recontouring and restoring natural slopes.
Road Maintenance	The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective (FSM 7712.3).
Road Construction (New)	Activity that results in the addition of forest classified or temporary road miles (36 CFR 212.1).
Road Reconstruction	Activity that results in improvement or realignment of an existing classified road a) **Road Improvement.** Activity that results in an increase of an existing road's traffic service level, expands its capacity, or changes its original design function. b) **Road Realignment**. Activity that results in a new location of an existing road, or portions of an existing road, and treatment of the old roadway (36 CFR 212.1).
Road Spot Reconstruction	Road reconstruction activities on very short sections of road. Generally involve activities such as culvert replacement and surface rock replacement
Salvage	Removal of dead trees or trees being damaged or dying due to injurious agents other than competition, to recover value that would otherwise be lost.
Sanitation	Removal of trees to improve stand health by stopping or reducing actual or anticipated spread of insects and disease.
Seral	The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.
Shelterwood Harvest	The removal of a stand in a series of usually three cuts over a period of time. Regeneration of the new stand occurs under the cover of a partial forest canopy. A final harvest cut removes the shelterwood and permits the new stand to develop in the open as an even-aged stand.
Silvicultural system	A planned series of treatments for tending, harvesting, and re-establishing a stand. The system name is based on the number of age classes (i.e. even-aged, two-aged, uneven-aged) or regeneration method (i.e. clearcutting, seed tree, shelterwood) used.

Term	Definition
Soil Compaction	Soil that has a 15% increase in bulk density over natural undisturbed conditions.
Soil Erosion Hazard	A rating of a soils potential to erode.
Stand	A community of trees or other vegetation sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and so form a silvicultural or management entity.
Stand Initiation Structural Stage	Vegetation stage that develops after a stand-replacing disturbance by fire, insects, or regeneration timber harvest. A new single-story layer of shrubs, tree seedlings, and saplings develop and occupy the site.
Stocking	The degree to which trees occupy the land, measured by basal area or number of trees by size and spacing, compared with a stocking standard such as the basal area or number of trees required for full utilization of the land's growth potential
Structure Class	A classification of forested cover types which aggregates Habitat Structural Stage into broader categories.
Succession	The process of vegetative and ecological development whereby an area becomes successively occupied by different plant communities.
System Roads	Also termed "Classified Roads." Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).
Temporary Road	A road necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or a forest trail and that is not included in a forest transportation atlas..
Threatened plant	A plant that is in danger of extinction throughout all or a significant portion of its range.
Uneven-aged stand	A stand of trees of three or more distinct age classes, either intimately mixed or in groups.
Trap Tree	A log or tree felled or treated in a manner to invite insect infestation, particularly bark beetles.
Water Influence Zone (WIZ)	The land next to water bodies where vegetation plays a major role in sustaining long-term integrity of aquatic systems. It includes the geomorphic floodplain, riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is 100 feet or the mean height of the mature dominant vegetation, whichever is most.
Wildfire	A fire that burns uncontrollably in a natural setting (e.g., a forest, or grassland).

Table A.2. Common Acronyms

AOI – Annual Operating Instructions	**LTA –** Landtype Association
AMP – Allotment Management Plan	**LAU –** Lynx Analysis Unit
BA – Basal Area	**MAP** – Management Area Prescription
BF- Board Foot	**MBF** – Thousand Board Feet
CCF – Hundreds of Cubic Feet	**MIS** – Management Indicator Species
CEQ – Council on Environmental Quality	**MMBF** – Million Board Feet
CWD- Course woody debris	**NEPA** – National Environmental Policy Act
CWPP – Community Wildfire Protection Plan	**NFMA** – National Forest Management Act
DBH – Diameter at Breast Height	**NFSR** – National Forest System Road
DSD – Detrimental Soil Disturbance	**PDC** – Project Design Criteria
DN – Decision Notice	**PFC** – Properly Functioning Condition
EA – Environmental Assessment	**RGNF** – Rio Grande National Forest
EIS – Environmental Impact Statement	**ROD** – Record of Decision
DAU – Data Analysis Unit	**ROS** – Recreation Opportunity Spectrum
DEIS – Draft Environmental Impact Statement	**RNA** – Research Natural Area
DHC – Dense Horizontal Cover	**SISS –**Stand Initiation Structural Stage
FAR –Functioning at Risk	**SRI** - Soil Resource Inventory
FEIS – Final Environmental Impact Statement	**SRLA** – Southern Rockies Lynx Amendment
FSH – Forest Service Handbook	**TES** – Threatened or Endangered Species
FSDMP – Forest Soil Disturbance Monitoring	**WIZ** – Water Influence Zone
FSR – Forest System Road	**WUI** – Wildland Urban Interface
FVS – Forest Vegetation Simulator	
HRV – Historical Range of Variability	
HUC – Hydrologic Unit Code	
IDT – Interdisciplinary Team	
IRA – Inventoried Roadless Area	

APPENDIX B

B.1 References Cited

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APPENDIX C

C.1. Past Timber Management activities in the Cumbres analysis area

Table C-1. List of past timber sales in the Cumbres analysis area boundary.

Los Pinos River Sale (Hanson)	1939	Shelterwood Preparatory Cut, Shelterwood Establishment Cut	1238, 235	1,3,4,6,7,11,12,13,14,17,20
Los Pinos (Hanson)	1941-57	Patch Clearcut	2651*	1,2,3,4,6,7,8,11,12,13,14,16,20
Neff Mountain	1963	Stand Clearcut	172	13,18,19
Hansen Lumber (Misc)	1967	Shelterwood Removal Cut	19	1,2
Skyline Lumber	1968	Commercial Thinning, Shelterwood Preparatory Cut	15, 15	9
Western Pine Ind (Los Pinos III)	1974	Shelterwood Preparatory Cut	343	2,3,4,16
Evergreen Lumber Co (Flat, Strawberry, Boat Ramp)	1976	Shelterwood Preparatory Cut, Overstory Removal Cut	313, 24	6,7,8,11,12,20
Rio Vista Log Co Dead	1979	Salvage, Shelterwood Establishment Cut	343, 116	2,3,4,7,16,20
Commercial Thinning (Misc)	1982	Thinning	118	3,16
Sandwich	1987	Overstory Removal	16	none
Stone Forest Ind (Pinos)	1988	Shelterwood Establishment Cut, Sanitation/Salvage	285, 170	1,2,3,16
TMC Salvage	1989	Log decks in campground	60	none
Cumbres	1991	Shelterwood Preparatory Cut, Intermediate Salvage	511	1,2,3,4,5,21,22
Trujillo Meadows Salvage	2000	Sanitation/Salvage	16	4,5
Neff Mountain Beetle Salvage	2004	Sanitation/Salvage	105	6,11,12
Neff II Salvage	2008	Sanitation/Salvage	103	6,11,12
*This number represents treated area and not patch cut size. Likely performed as part of the Los Pinos River Sale.				

Table C-2. List of other silvicultural activities in the analysis area.

Year	Treatment	Acres	Units Affected
Unknown	Precommercial Thinning	Unknown	7,20
1970	Reforestation	132	18,19
1980	Reforestation	6	none

C.2 Research Project - *Osha* (*Ligusticum porteri*) study

Figure C-1. Osha stand (bright green plants) in original study plot established in 2002 in a late 1970s clear-cut just outside the current analysis area. Photo by Vnce Spero 2002.

In 2002, the Rio Grande National Forest and the Partners for Plants/Plant Conservation Alliance Medicinal Plant Working Group (PCA-MPWG) initiated an *Osha* harvest and monitoring project designed as a long-term effort to collect data that would lead to the greater understanding of the ecological status and sustainability of the plant for which little botanical data is available. The 10-acre study plot was established on Cumbres Pass, Colorado, approximately 2 miles west of Trujillo Meadows Reservoir and the current analysis area. The plot is in a clear-cut (late-1970s) on the south facing forested slope above Wolf Creek at an elevation of 11,000 feet and slope between 5° and 10°. Vegetation in the clear-cut area consists of Osha, elderberry, strawberry, and fescue. Forested vegetation surrounding the clear-cut consists of an over story of Engelmann spruce and subalpine fir with an understory of vaccinium and heartleaf arnica.

The inventory and harvest project was led by Trish Flaster (Botanical Liaisons, LLC Executive Director and chair of the MPWG Conservation and Ethnobotany Committees) and then Forest Archaeologist, Vince Spero. Fieldwork was provided by 24 volunteers that collected baseline data for *Osha* at this test site and refined a collection protocol initially devised for use with black cohosh in the Appalachian Mountains (Figure 2). Plants were identified, measured, and permanently tagged and numbered, with a percentage of randomly selected plots harvested lightly and others harvested more intensely. Root material was sent to the University of Mississippi to be analyzed for active ingredients. In 2003, the Rio Grande National Forest hosted the second *Osha* PCA-MPWG inventory and harvest. Fieldwork was also provided by volunteers (Figure 2). This project collected more baseline data for *Osha* and drew upon a diverse collection of community volunteers, thus expanding community recognition of the value of native wild plants. A total of 14 -5x20 M plots were installed, 769 plants were identified, their X and Y coordinates were taken, plants measured, and mature plants that were harvested were permanently tagged and numbered. Monitoring and harvesting at the plot also occurred 2004 and 2005. Weather likely impacted data collection over the course of the study with major drought effects in 2002 and snow in 2003.

Figure C-2. Volunteers map Osha plant within study plot in 2003. Photo by Vince Spero.

The plant is in the Apiaceae family and grows at higher altitudes, usually above 6,000 feet, often in moist aspen groves but also found in well drained and disturbed areas such as old clear-cuts and burned areas. Timber staff has observed that the plant often responds positively to disturbance much the way aspen does. Traditional cultures are known to harvest the root after the seeds form in September. It is used as a talisman to ward off snakes, as well as for stomach and respiratory ailments. Tea, tinctures, cough syrups and chewing the root raw are the most common forms of delivery. Increasing popularity, limited populations, and difficulties associated with harvest of *Osha* make a long-term monitoring study critical at this time.

In 2010, Trish Flaster of Botanical Liaisons LLC and Kansas University ethnobotanist Dr. Kelly Kindscher revisited the 2002 study plot with students and volunteers to revive the study. During the subsequent analysis of the data, they ran tests for each year of the data with treatment (0%, 33%, and 66% harvest) as the factor and ran analysis for several different response variables that were calculated for each replicate plot (cumulative plant height, cumulative width, average height, average width, # of mature plants, # of juvenile plants, total # of plants, total # of inflorescences, and average # of inflorescences per mature plant). The result is that there were no significant differences between treatments in any year. While it initially seems to be a positive result that there was no effect of harvest in 2010, apparently illustrating that the populations had rebounded entirely regardless of harvest intensity. However, this assertion is statistically invalidated by the results from previous years, which surprisingly demonstrate that there were no differences between treatments even in the year following the original harvest when one should obviously expect to find a significant effect of harvest. The lack of significant results across all years is due to the amount of variance in the data. It is believed that this is a result of there being many differences between plots naturally, that there were problems with the data collection, plot numbers, data entry in years past, and perhaps some lack of quality control. Regardless, it appears through observation that *Osha* was quite resilient to harvest in the plots sampled. To acquire more data to support this, KU is proposing a new study plot and experimental design as well as a mapping project within the analysis during the 2012 field season. To fund this work, Botanical Liaisons LLC., KU and the RGNF are partnering on a proposal to the American Herbal Products Association's Foundation for Education and Research on Botanicals (AHPA-ERB Foundation). The Forest Service has pledged Inventory and Monitoring funding as a match and local Hispanic school groups and herbalists will be recruited to assist in the mapping project.

In 2011 RGNF archaeologists and the soils scientist made note of *Osha* populations while surveying within the analysis area. Both observed light concentrations within proposed salvage units and denser concentrations of the plant in open meadows, tree line edges and old clear-cuts. Eight

locations were documented with a GPS point, a photo and a narrative description of the environment of each locale (Figure C-3). Points were chosen inside and outside of proposed salvage units. More photo points will be established within proposed salvage units during the 2012 field season and harvest units within the County Line Timber Sale (2007) will be visited to determine if *Osha* is recruiting within recently logged units.

Figure C-3. Photo Point C established in 2011. Note well established Osha plants in the lower left within old clear-cut dotted with planted trees. Photo by Ken Frye.

This project analysis provides a unique opportunity to study *Osha* on three fronts: 1) The Forest Service will monitor the impacts of timber harvest on the plant through time to gauge whether or not salvage logging substantially impacts plant populations. Healthy populations within old clear-cuts suggest that the plant responds favorably to such disturbance; 2) Information on local collection areas and practices will be sought in order to protect and preserve local collection areas for personal use; 3) Establishing a new study plot to research sustainable collection practices will be important to clarify how *Osha* responds to differing levels of harvest activity in order to prescribe sustainable harvest methods. If managed appropriately, the plant could be commercially harvested on a small scale as a Special Forest Product affording economic opportunities to depressed local Hispanic and tribal communities.

C.3 Soils Data

Table C-3. Soil data by unit for Cumbres project area.

SOIL ATTRIBUTE	HARVEST UNIT NUMBER															
	1	3	5	6	7	8	9	10	11	12	13	14	17	20	21	Av.
Forest. floor depth (cm):	1.3	1.2	1.7	1.6	1.3	1.4	1.8	1.8	3.9	1.9	1.6	1.3	1.3	1.4	1.2	1.65
Forest floor Impacted?	0.35	0.27	0.42	0.40	0.52	0.33	0.00	0.13	0.43	0.32	0.32	0.41	0.25	0.39	0.31	0.32
Live Plant	1.00	0.97	0.90	0.91	1.00	0.97	0.80	0.83	0.83	0.94	0.97	1.00	0.88	1.00	0.91	0.93
Fine Woody <7 cm	0.87	0.63	0.68	0.71	0.81	0.73	0.80	0.77	0.90	0.84	0.90	0.75	0.75	0.74	0.63	0.77
Coarse Woody >7cm	0.52	0.53	0.68	0.51	0.42	0.53	0.70	0.53	0.50	0.58	0.61	0.53	0.50	0.45	0.34	0.53
Bare Soil	0.16	0.33	0.29	0.06	0.26	0.33	0.13	0.20	0.13	0.07	0.16	0.31	0.28	0.29	0.28	0.22
Rock?	0.13	0.03	0.23	0.00	0.19	0.17	0.00	0.07	0.03	0.00	0.00	0.09	0.22	0.16	0.03	0.09
Topsoil displacement?	0.10	0.17	0.26	0.11	0.19	0.17	0.07	0.03	0.20	0.06	0.06	0.06	0.09	0.19	0.13	0.13
Erosion?	0.00	0.07	0.16	0.06	0.00	0.10	0.00	0.00	0.10	0.00	0.00	0.00	0.06	0.00	0.19	0.05
Rutting? <5cm	0.03	0.03	0.13	0.11	0.06	0.10	0.03	0.07	0.10	0.03	0.10	0.03	0.00	0.00	0.06	0.06
Rutting? 5-10cm	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Rutting? >10cm	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Compaction? 0-10 cm	0.35	0.37	0.45	0.46	0.45	0.27	0.00	0.23	0.30	0.26	0.26	0.31	0.31	0.29	0.44	0.32
Compaction? 10-30 cm	0.13	0.20	0.10	0.11	0.16	0.17	0.13	0.10	0.20	0.19	0.23	0.16	0.19	0.13	0.13	0.15
Compaction? >30cm	0.03	0.03	0.00	0.06	0.06	0.03	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.03	0.00	0.02
Platy/Massive/Puddled structure 0-10 cm	0.16	0.13	0.23	0.31	0.39	0.10	0.00	0.17	0.10	0.16	0.26	0.09	0.13	0.19	0.16	0.17
Platy/Massive/Puddled structure 10-30 cm	0.10	0.10	0.06	0.11	0.10	0.13	0.00	0.03	0.20	0.00	0.10	0.03	0.09	0.03	0.03	0.07
Platy/Massive/Puddled structure >30 cm	0.00	0.00	0.00	0.03	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.01
Slope > 30%	0.16	0.23	0.10	0.00	0.10	0.13	0.23	0.07	0.23	0.19	0.13	0.25	0.13	0.00	0.00	0.13
Soil Disturbance Class																
0	0.65	0.77	0.68	0.57	0.61	0.83	1.00	0.87	0.73	0.84	0.84	0.72	0.78	0.74	0.81	0.76
1	0.29	0.23	0.32	0.34	0.42	0.30	0.00	0.10	0.37	0.29	0.26	0.38	0.28	0.32	0.25	0.28
2	0.06	0.00	0.00	0.06	0.06	0.00	0.00	0.03	0.07	0.00	0.03	0.00	0.00	0.03	0.03	0.02
3	0.00	0.00	0.00	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.01
Detrimental (Proportion)	0.13	0.07	0.10	0.20	0.23	0.10	0.00	0.07	0.17	0.06	0.10	0.09	0.09	0.16	0.09	